

EDITORIAL
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MAGAZINE

MAY 28, 1991

THE INDEPENDENT GUIDE TO PERSONAL COMPUTING

VOLUME 10 NUMBER 10

Database Clout!

C Labs Tests 15
Relational Powerhouses

Application
Development:
More Power to You

Screen Painting,
Menus, QBE:
Ease of Use Matters!

dBASE IV 1.1:
Market Leader, Yes;
Technology Leader, No

FIRST LOOKS

**HP's Amazing New
Palmtop: \$695,
Infrared Remote,
1-2-3 in ROM**

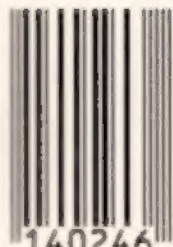


ENDURANCE TESTS

**33-MHz 386s: Zeos,
Dell, CompuAdd, and
Polywell Stand Up
To a Year's Hard Use**

FREE UTILITY

**Your WIN.INI File
Is a Mess!
Clean It Up
With PROG.SET**



22

\$2.95
0 140246 9

It took us
thousands of
steps to make
this spreadsheet
do what we
wanted.

B

Pro Forma In

1991

184,845

49,292

1,232,300

1,466,437

184,845

"Now all of my customers can afford to put a 486ASX on every desk."

Richard D. Darrell, President, Direct Computer Corporation



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486ASX



PowerFlex
486ASX



BusinessStation
486ASX

*Just Upgrade
the CPU!*

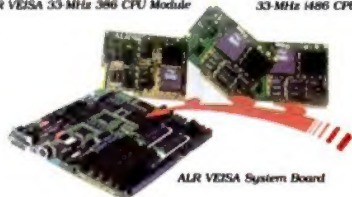


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simply add a math
coprocessor.

ALR VEISA 25-MHz 486 CPU Module

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33-MHz 486 CPU Module



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the CPU!** whenever you need more
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Notebook and the grand prize of one
new **ALR BusinessVEISA 486ASX**
with Microsoft® MS-DOS® 4.01 &
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MIPS Benchmarks

MIPS (million instructions per second) Higher score represents better performance

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26% increase in performance	
BusinessVEISA 486ASX with SuperCharge 486 CPU/Math Chip	11.1

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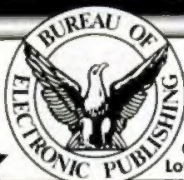
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CPU	20-MHz i486SX	20-MHz i486SX	20-MHz i486SX	20-MHz i486SX
Bus Architecture	ISA	EISA	EISA	Micro Channel
RAM Standard	1-MB	1-MB	1-MB	1-MB
Floppy Standard	1.44-MB	1.2-MB	1.2-MB	1.44-MB
Storage Bays	4	4	3	4
Total Slots	6	9	5	8
Starting List Price	\$1995	\$2795	\$3295	\$2995
Upgrade Path	ALR SuperCharged 486 CPU/Math Chip, 25-MHz i486 Module	ALR SuperCharged 486 CPU/Math Chip, 25-MHz i486 Module, 33-MHz i486 Module	ALR SuperCharged 486 CPU/Math Chip, 25-MHz i486 Module, 33-MHz i486 Module	ALR SuperCharged 486 CPU/Math Chip, 25-MHz i486 Module, 33-MHz i486 Module

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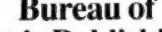
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Inside

This issue's cover story on programmable relational databases is our first major comparative evaluation of high-end databases since a special issue was devoted to the topic in 1988. Our 15 evaluations prove that much in this crowded market has changed for the better since then.

In charge of finding the best ways to discover and document the innovation in the databases we tested was Gabrielle Gagnon, the newly appointed project leader in charge of software testing in PC Magazine Labs.

What Gagnon brought to the project was a wealth of experience—experience cultivated throughout a long career as a computer consultant and as Columbia Pictures' Manager of Advanced Technology.

It wasn't easy, but Gagnon designed a brand new suite of benchmark tests even more rigorous than those we've used in the past. Our new 12-part test is based on ANSI SQL Standard Scalable and Portable database benchmarks developed at Cornell University.

To guarantee that we would test each package in the way best suited to it, the database vendors were invited to participate.

First, we asked the vendors to code the benchmark specifications to their packages' programming language, thereby insuring testing with the tightest possible code.



Second, we urged each vendor to send a technical representative to PC Labs to act as a trouble-shooter while their package was tested, just as you would call in a consultant or on-site database specialist for assistance with your database applications.

Though coordinating the testing schedule and the vendor participation was a supreme logistical challenge (just ask PC Labs assistant Carolyn Falconer, who did it), the effort paid off.

The vendors got an opportunity to learn things about their packages they didn't already know (and perhaps plan for future performance improvements). And since there's no doubt the software was tested in its optimal configuration, you can be sure that the results accurately reflect the packages' real-world performance.

real-world performance.

New database benchmarks aren't the only innovation you'll find in this issue. A new column, Toolkits, joins the lineup right after the First Looks section. Edited by senior editor Trudy Neuhaus, Toolkits includes evaluations of the latest libraries, debuggers, compilers, linkers, and more. Contributing editor Ray Duncan writes the first column, which includes an evaluation of Phar Lap's 286 DOS Extender.

To make room for Toolkits, the Advisor column has moved to the back of the magazine, between Tutor and After Hours.—Don Willmott ■



Software project leader Gabrielle Gagnon designed tough new benchmark tests for our database evaluations.

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Screaming 1-year-old rattles industry.

The IBM RISC System/6000 family keeps delivering performance that's positively hyperactive.

Talk about precocious. Just a little over one year ago, when we proudly announced the arrival of the RISC System/6000™ POWERstations and POWERservers, they were already way ahead of the other kids in their class, delivering amazingly high performance for their diminutive price range.

	Hardware Price	MFLOPS	SPECmarks™
POWERstation 320H	\$17,972	11.7	32.4
SPARCstation 2	\$14,995	4.2	21.0
DECstation 5000	\$19,395	3.7	18.5

Now, we're introducing the new RISC System/6000 POWERstation 320H. It runs 11.7 MFLOPS* and 32.4 SPECmarks*. If you already have the original POWERstation 320, you can upgrade it now to the even more spectacular performance of the 320H.

YET ANOTHER NEW ADDITION TO THE FAMILY.

Our POWERserver 950 is also brand spanking new. It gives you the performance of the POWERserver 550—25.2 MFLOPS and a SPECmark of 56.3—but in a rack-mounted system, to share more disk storage, power and expandability with others. And all the models in the UNIX®-based RISC System/6000 family can now add disk expansion units for up to quadruple their previous maximum fixed disk storage. This yields up to 22.2GB on the POWERserver 950.

A NEW BOX OF CRAYONS.

Then there's the POWERgraphics GTO graphics subsystem. It can attach to any model in the RISC System/6000 family, to deliver super graphics performance previously available only in the

POWERstation 730—990,000 3D vectors/second and 120,000 shaded polygons/second.

MEMORY AT PRICES THAT WON'T CAUSE TANTRUMS.

And now you can get more memory for less. The more memory you buy, and the bigger the increments, the less you pay per MB. After all, just because we're a year old doesn't mean we don't know the value of money. Especially yours.

To find out more about the RISC System/6000 family, call 1 800 IBM-6676, ext. 878. And if you think this one-year-old is a handful now, just wait until the terrible twos.



For the Power Seeker.

*SPECmark is a geometric mean of the ten SPECmark tests. MFLOPS are LINPACK double precision where n=100. AIX XL FORTRAN Version 2.1 and AIX XL C Version 1.1 compilers were used for these tests.

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IBM (®)

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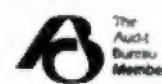
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**What's the
difference
between an
Austin and
a Dell PC?**



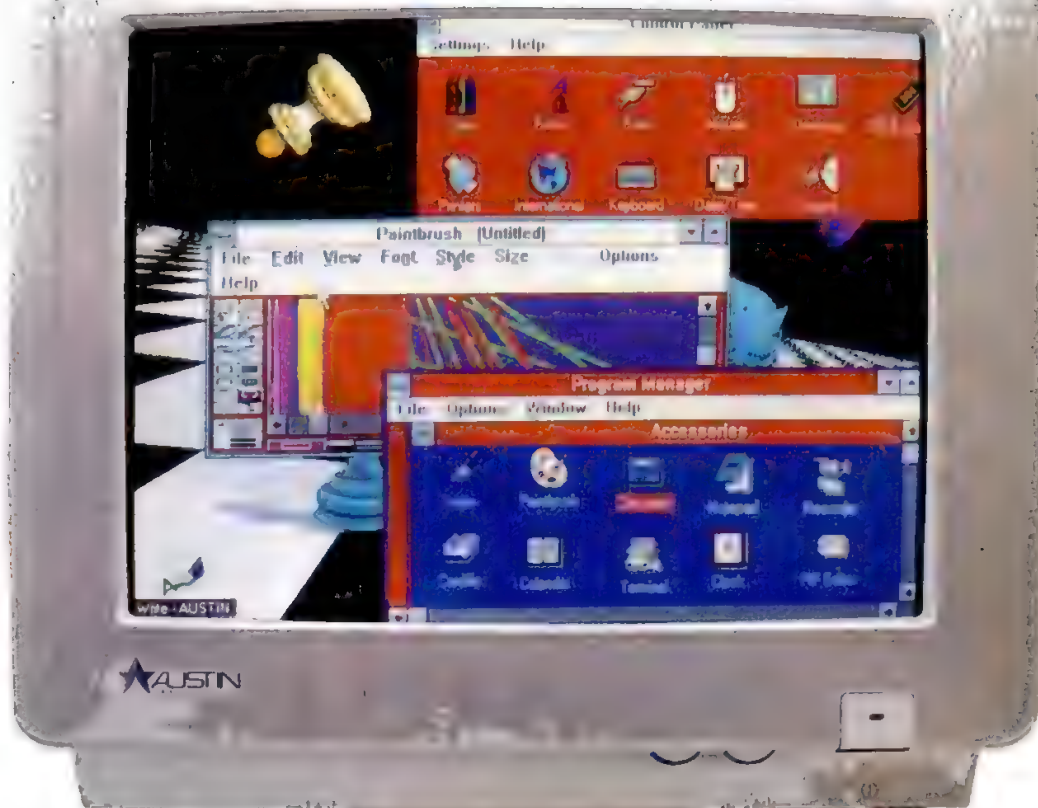
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386/SX16
1990



Editors
Choice
286/12.5
1989



Editors
Choice
386/SX20
U.K. 1991



386/SX-16

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1 Floppy Drive
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GE On-Site Service

\$1490

Upgrade to VGA Color
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The Price.

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We believe in giving you more than just a top-quality computer. We also believe in value, and in giving you as much for your dollar as you deserve.

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"Austin Computer Systems has a winning combination... How can you lose?" *PC Magazine* 286/12.5

Editor's Choice Award, 1/31/89 Issue

"Austin Computer Systems is on a roll..." Fredric Burke, *PC Magazine*

Computer Consultant, 9/25/90 Issue

"Austin's 386/25 WinStation is a system loaded with value..."

PC Magazine Editor's Choice Review, 1/29/91 Issue

"Do yourself a favor and check out the Austin 386/SX."

Computer Shopper, April 1990 Issue

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Douglas Figgs, New York Engineer, *PC Magazine* Service and Reliability Review, 9/25/90



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AUSTIN 286/16 STANDARD CONFIGURATION

Microprocessor: 80286 running at 16MHz.
Special Features: GE on-site service.
Storage: 40Mb IDE hard drive. 1.44Mb or 1.2Mb floppy disk drive.
Memory: 1Mb RAM
Expansion: 7 expansion slots (6 16-bit and 1 8-bit).
I/O Ports: 1 parallel and 2 serial ports.
Video: TTL monochrome monitor with video adapter.
Keyboard: Enhanced 101 keyboard with tactile/click touch.
Compatibility: DOS, OS/2, Novell, Unix.

\$1890

AUSTIN 386/SX16 WINSTATION STANDARD CONFIGURATION

Microprocessor: Intel 80386SX running at 16MHz.
Special Features: Pre-loaded with Microsoft Windows 3.0 and MS-DOS 4.01. Microsoft mouse. GE on-site service.
Storage: 40Mb IDE hard drive. 1.44Mb or 1.2Mb floppy disk drive.
Memory: 2Mb RAM
Expansion: 7 expansion slots (6 16-bit and 1 8-bit).
I/O Ports: 1 parallel and 2 serial ports.
Video: 14" VGA color monitor with 16-bit VGA color video adapter.
Keyboard: Enhanced 101 keyboard with tactile/click touch.
Compatibility: DOS, OS/2, Novell, Unix.

\$1990

AUSTIN 386/SX20 WINSTATION STANDARD CONFIGURATION

Microprocessor: Intel 80386SX running at 20MHz.
Special Features: Pre-loaded with Microsoft Windows 3.0 and MS-DOS 4.01. Microsoft mouse. GE on-site service.
Storage: 40Mb IDE hard drive. 1.44Mb or 1.2Mb floppy disk drive.
Memory: 2Mb RAM
Expansion: 7 expansion slots (6 16-bit and 1 8-bit).
I/O Ports: 1 parallel and 2 serial ports.
Video: 14" VGA color monitor. 16-bit VGA color video adapter.
Keyboard: Enhanced 101 keyboard with tactile/click touch.
Compatibility: DOS, OS/2, Novell, Unix.

\$2590

AUSTIN 386/25 WINSTATION STANDARD CONFIGURATION

Microprocessor: Intel 80386 running at 25MHz.
Special Features: Pre-loaded with Microsoft Windows 3.0 and MS-DOS 4.01. Microsoft mouse. GE on-site service.
Storage: 90Mb IDE hard drive. 1.44Mb or 1.2Mb floppy disk drive.
Memory: 2Mb RAM
Expansion: 7 expansion slots (6 16-bit and 1 8-bit).
I/O Ports: 1 parallel and 2 serial ports.
Video: 14" VGA color monitor. 16-bit VGA color video adapter.
Keyboard: Enhanced 101 keyboard with tactile/click touch.
Compatibility: DOS, OS/2, Novell, Unix.

AUSTIN 286/16 1MB RAM AND 1 FLOPPY DRIVE STARTING AT \$1090 OR \$33 PER MO.				
CHOOSE MONITOR BELOW				
CHOOSE HARD DRIVE BELOW	TTL MONO CHROME	VGA MONO CHROME	VGA COLOR 640 X 480	
40MB IDE	\$1090	\$1255	\$1470	
90MB IDE	\$1310	\$1435	\$1650	
125MB IDE	\$1440	\$1585	\$1790	
200MB IDE	\$1620	\$1945	\$2190	

OTHER OPTIONS ARE AVAILABLE. CALL FOR DETAILS.

AUSTIN 386/SX16 WINSTATION 2MB RAM AND 1 FLOPPY DRIVE STARTING AT \$1890 OR \$45 PER MO.				
CHOOSE MONITOR BELOW				
CHOOSE HARD DRIVE BELOW	TTL MONO CHROME	VGA COLOR	1024 X 768 VGA COLOR	
40MB IDE	\$1490	\$1890	\$2035	
90MB IDE	\$1755	\$2095	\$2215	
125MB IDE	\$1885	\$2225	\$2345	
200MB IDE	\$2265	\$2605	\$2725	

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AUSTIN 386/SX20 WINSTATION 2MB RAM AND 1 FLOPPY DRIVE STARTING AT \$1990 OR \$36 PER MO.				
CHOOSE MONITOR BELOW				
CHOOSE HARD DRIVE BELOW	VGA MONO CHROME	VGA COLOR	1024 X 768 VGA COLOR	
40MB IDE	\$1845	\$1990	\$2180	
90MB IDE	\$2025	\$2240	\$2360	
125MB IDE	\$2155	\$2370	\$2490	
200MB IDE	\$2535	\$2750	\$2870	

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AUSTIN 386/25 WINSTATION 2MB RAM AND 1 FLOPPY DRIVE STARTING AT \$2290 OR \$67 PER MO.				
CHOOSE MONITOR BELOW				
CHOOSE HARD DRIVE BELOW	VGA MONO CHROME	VGA COLOR	1024 X 768 VGA COLOR	
40MB IDE	\$2220	\$2435	\$2555	
90MB IDE	\$2400	\$2695	\$2735	
125MB IDE	\$2530	\$2745	\$2965	
200MB IDE	\$2910	\$3125	\$3245	

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Difference!



\$3290

AUSTIN 386/33 WINSTATION STANDARD CONFIGURATION

Microprocessor: Intel 80386 running at 33MHz.
Special Features: 128K system cache. Pre-loaded with Microsoft Windows 3.0 and MS-DOS 4.01. Microsoft mouse. GE on-site service. Small footprint chassis.
Storage: 125Mb IDE hard drive with 32K cache. 1.44Mb or 1.2Mb floppy disk drive.
Memory: 4Mb RAM
Expansion: 7 expansion slots (6 16-bit and 1 8-bit).
I/O Ports: 1 parallel and 2 serial ports.
Video: 14" VGA color monitor. 16-bit VGA color video adapter.
Keyboard: Enhanced 101 keyboard with tactile/click touch.
Compatibility: DOS, OS/2, Novell, Unix.

486-25 NEW ISA Product!



\$3990

AUSTIN 486/25 WINSTATION STANDARD CONFIGURATION

Microprocessor: Intel 80486 running at 25MHz.
Special Features: Internal 8K cache floating point unit. Pre-loaded with Microsoft Windows 3.0 and MS-DOS 4.01. Microsoft mouse. GE on-site service.
Storage: 125Mb IDE hard drive with 32K cache. 1.44Mb or 1.2Mb floppy disk drive.
Memory: 4Mb RAM (expands to 32Mb on system board).
Expansion: 8 16-bit ISA expansion slots
I/O Ports: 1 parallel and 2 serial ports.
Video: 14" VGA color monitor. 16-bit VGA color video adapter.
Keyboard: Enhanced 101 keyboard with tactile/click touch.
Compatibility: DOS, OS/2, Novell, Unix.

486/33 NEW Product!



\$7990

AUSTIN 486/33E WINSTATION STANDARD CONFIGURATION

Microprocessor: Intel 80486 running at 33MHz.
Special Features: EISA bus architecture. Internal 8K cache and floating point unit. Optional 64K or 128K external cache. Landmark v1.14 rating-167.8 MHz. Power meter rated @ 14.93 MIPS. Shadow RAM. EMS LIM 4.0 support. Microsoft package. GE on-site service. Vertical chassis.
Storage: 1.2Gb SCSI hard drive. 1.44 Mb or 1.2Mb floppy disk drive.
Memory: 8Mb RAM (expands to 64Mb on system board).
Expansion: 8 32-bit EISA bus master.
I/O Ports: 2 parallel and 2 serial ports.
Video: 14" VGA monochrome monitor. VGA video adapter.
Keyboard: Enhanced 101 keyboard.
Compatibility: Novell, DOS, OS/2 and Unix.

NEW ISA Product!



\$2295

AUSTIN 386/SX16 NOTEBOOK STANDARD CONFIGURATION

Microprocessor: 80386SX running at 16MHz.
Special Features: Weight 6.1 lbs. without batteries. Notepad size. Dual removable battery packs for up to 4 hour battery life. Visual/Audio low battery warning indicator. Leather carrying case. Batteries and recharger included.
Storage: 20Mb hard drive. 1.44Mb floppy disk drive.
Memory: 2Mb RAM (expands to 8Mb on system board).
Expansion: 2 expansion pack slots. External VGA monitor port. External keyboard port. Printer port. 2 serial ports (1 for modem pack).
Video: Brilliant 10" VGA display with 640 x 480 resolution and 32-gray scale.
Keyboard: Full size, embedded numeric pad with 12 function keys.
Compatibility: DOS.

AUSTIN 386/33 WINSTATION 4MB RAM AND 1 FLOPPY DRIVE STARTING AT \$2820 OR \$85 PER MO.

CHOOSE MONITOR BELOW			
CHOOSE HARD DRIVE BELOW	VGA MONO CHROME	VGA COLOR	1024 x 768 VGA COLOR
40MB IDE	\$2820	\$3035	\$3155
90MB IDE	\$3000	\$3215	\$3335
125MB IDE	\$3130	\$3280	\$3435
200MB IDE	\$3510	\$3725	\$3845

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AUSTIN 486/25 WINSTATION 4MB RAM AND 1 FLOPPY DRIVE STARTING AT \$3680 OR \$117 PER MO.

CHOOSE MONITOR BELOW			
CHOOSE HARD DRIVE BELOW	VGA MONO CHROME	VGA COLOR	1024 x 768 VGA COLOR
125MB IDE	\$3680	\$3880	\$4105
200MB IDE	\$4280	\$4475	\$4585
330MB SCSI	\$4730	\$4945	\$5085
1.2GB SCSI	\$6180	\$6385	\$6515

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AUSTIN 486/33E WINSTATION 8MB RAM AND 1 FLOPPY DRIVE STARTING AT \$6730 OR \$177 PER MO.

CHOOSE MONITOR BELOW			
CHOOSE HARD DRIVE BELOW	VGA MONO CHROME	VGA COLOR	1024 x 768 VGA COLOR
330MB SCSI	\$6730	\$6945	\$7085
1.2GB SCSI	\$7980	\$8385	\$8515

OTHER OPTIONS ARE AVAILABLE. CALL FOR DETAILS.

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CIRCLE 347 ON READER SERVICE CARD

Letters

■ WINDOWS AND GUIs, YEA!

How can you expect me to take your magazine seriously when you publish ludicrous remarks like the ones from Messrs. Machrone and Seymour about *Microsoft Windows* and GUIs in the February 12, 1991, issue?

Machrone complains of the high cost of effective GUI word processing, but when real-world cost comparisons are made, his objections are shown to be without merit. A sophisticated GUI WYSIWYG word processor costs only about \$270 more than its character-based siblings—and it's well worth the difference.

Getting *Windows* installed and humming isn't as difficult as Seymour makes it out to be, and thanks to *Windows 3.0*, my wife is using a PC for the first time.

David A. Barnhart
Glendale, Arizona

Now that John C. Dvorak has conceded that the graphical user interface is an unintuitive "marketing crock" (March 12, 1991), I wish he would take the next step and explain why, in my office filled with PCs and Macs, people line up to use the Macs. (Some days I feel like I'm working in a commercial.)

I think Dvorak has forgotten what it's like for the average worker to cope with the PC command line interface to cut and paste from one program to another, copy and arrange files, or whip up a few graphs before 5 P.M.

While no computer is completely intuitive, the average worker using a graphical interface can be productive almost immediately. He does need some training, but he is thankful that the graphical interface shields him from the frequently confusing command line, which is rapidly disappearing from corporate America.

Richard Carman
Clinton, New York

I am moved to comment on John C. Dvorak's "Windows, the Mac, and DOS" (January 29, 1991). He can't imagine how



The flood of *Windows* letters, pro and con, hasn't let up yet.

anyone would use *Windows 3.0* just to make a "cheap Mac kind of machine."

Mr. Dvorak is fortunate to have both a 486 and a Mac to work with. Does he really think that most computer users have multiple machines strewn about their houses? Please! I can't afford a machine for each kind of software I wish to use, and neither can my employer. In this regard, I dare say that I am in the majority, and Mr. Dvorak is not.

He seems to miss the whole point of *Windows*. It is *not* an operating system. It is an application. It does not take over and consume your machine so you are forced to buy *Windows*-compatible software. So if you have the resources for only one machine, why not DOS and *Windows*?

Marvin E. Perkins III
Franklin Park, New Jersey

■ WINDOWS AND GUIs, NAY!

By promoting *Windows* despite its cost, bugs, and poor performance, *PC Magazine* has been a major contributor to GUI hype. Finally, someone at *PC* has come clean—sort of—about the many disadvantages of *Windows*.

Bill Machrone's February 12 column pointed out some of the headaches in store for anyone trying to use a *Windows*-based word processor. But I wish he'd had the guts to discuss the real problem with these programs: There is no inherent advantage to graphical word processors, because words are made up of characters and they are intended to convey ideas. Word processors are primarily tools for writing, not desktop publishing. Machrone is right about one thing: Want a real GUI—buy a Mac!

Lisa R. Hirsch
Oakland, California

Shortly after you published a letter of mine that was critical of *Windows* (Letters, February 26, 1991), I received an anonymous phone threat stating that I would be "sorry for siding with Petzold." It confirmed my suspicions about the mentality of some *Windows* boosters.

For the more rational *Windows* fans who are looking forward to *Windows-32*, however, I ask the following question: Since the capabilities promised for *Windows-32* are no more than those *already* present in OS/2, Version 2.0, how many years are *Windows* users prepared to wait for *Windows* to catch up?

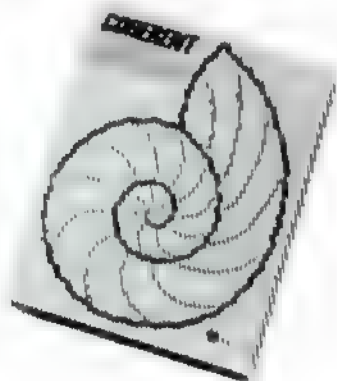
Wayne Johnson
Becker, Minnesota

Whenever I see a *Windows* demo, the spiel goes, "Now you can run your PC *almost* like a Mac." That raises the hair on the back of my neck. Is it an insult to the Mac or to *Windows*?

After spending millions of dollars, couldn't Microsoft make a GUI that's better than the Mac's? *Windows* looks like an experimental Mac interface. Maybe Steve Jobs (the master) was right after all when he predicted back in 1983 that all computers will run like the Mac someday. But is that good enough for the power of tomorrow's PC hardware?

Dave Newsome
Olympia, Washington

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Letters

Life has slowed at Paper Castle. I see King Bill, Sir John, and Sir Jim pushing hard to close the Win 3 floodgates. These same gates were opened wide by Sir Jim himself, who several months ago condemned to computerdom's backwaters all who didn't wholeheartedly embrace GUIs. Alas, confusion reigns in the realm, for we are but fickle subjects, and your whims and fancies we must endure, lest our fortnightly taxes be increased in turn for your royal scrolls and proclamations.

Derek Hawkins
Astoria, New York

CLICKING ALL OVER

As a Windows teacher, I suppressed a few shudders at Barry Simon's recommendation that Windows users should "double-click all over" in "Tips, Tricks, and Hints for Windows 3.0" (February 26, 1991). What he suggests is exactly what nervous Windows beginners and compulsive clickers do: Click, click, click.

The result is a mangled screen collage where five clocks, two Writes, Reversi, Solitaire, and a plethora of icons compete for desktop space while a sweating, bewildered user asks, "What happened?"

Vic Burton
San Diego, California

A TOAST TO THE AMIGA!

Wait a minute. Was I really reading *PC Magazine*, that bastion of DOS compatibility? Was there really an article (February 26, 1991) that not only lauded the capabilities of NewTek's Amiga board, the Video Toaster, but also stated that "the Amiga has always been a fundamentally better video machine than the PC"?

And was that John C. Dvorak in that same issue saying "The actual highlight of Comdex was an Amiga add-in card called the Video Toaster"? The same man who a few months earlier referred to the waning usefulness of "the lingering Amiga"?

Perhaps the PC world is finally awakening to what Amiga users have known all along: There is no better machine for video and graphics than the Commodore Amiga. Many have downed the Amiga because it began life as the ultimate game machine. Well, Abraham Lincoln began life as a fertilized ovum.

D. Timothy Estes
Danville, Kentucky

VIRAL VANDALISM

I've long enjoyed John C. Dvorak's columns. Sometimes he's brilliant and sometimes he appears to stir controversy just for the hell of it. This time (February 12, 1991) he's ventured beyond the bounds of sanity.

A person who writes a virus is neither a "software purist" nor interested in "unex-

**I hate to stick the
smelling salts under
Dvorak's nose, but
any programmer can
write a virus.**

plored realms." Such a person is an immature vandal attempting to overcome well-deserved feelings of inferiority. I guess John Dvorak is so wealthy that he considers a multimillion dollar loss "two-bit vandalism."

I hate to stick the smelling salts under his nose, but any intermediate programmer can write a virus. Just as most people won't stoop to vandalizing your car, however, most programmers won't stoop to vandalizing your data or hardware.

Terrence E. Vaughn
West Covina, California

TO TREE OR NOT TO TREE

I am compelled to respond to W. Peter Janicki's criticism of Gateway 2000's use of high-quality paper for its advertisements in *PC Magazine* (Letters, February 26, 1991). This practice reflects its commitment to use only high-quality materials in everything it produces.

Beyond that, I remind Mr. Janicki that trees used for the production of wood-pulp are a renewable resource.

Roger P. Pecoraro
New Orleans, Louisiana

I must join with reader W. Peter Janicki in voicing my displeasure with glossy sheet advertisers. Any company, in this day and age, so totally insensitive to the environment as to use this medium is not going to get my attention!

Maggie Mangan
Morristown, New Jersey



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Eight Low-Cost Systems Perform Well; Video and Hard-Disk Components Var

By David Claiborne

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PC WEEK

Analyst's Choice, February 18, 1991

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PC Sources
486/33 Lead Review, February 1991

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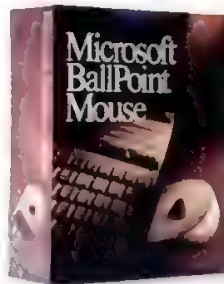
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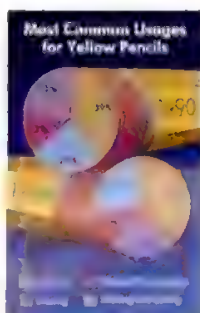
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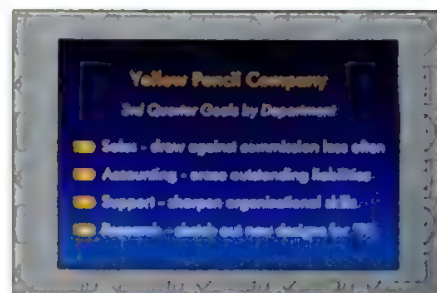
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Letters

Your advertisers should know that the first thing I do when I receive *PC Magazine* is get out my trusty single-edged razor blade, cut out all that glossy sheet advertising and toss it in the recycling bin. Then I go after the card inserts and do the same.

Vittorio Nicosia
Tujunga, California

SURVIVAL OF THE FITTEST

Jim Nietopski (Letters, February 12, 1991) wondered how many clone vendors from 1988 or 1989 have disappeared "lock, stock, and warranty." That question interested me, so I did a little checking.

Fourteen clone makers/marketers had two or more pages of advertising in each of the two January 1988 issues of *PC Magazine*; 12 of those, and 4 others, also appeared in both January 1989 issues. Of the 14 from 1988, 9 are still advertising nationally; of the 16 from 1989, 13 are clearly still around.

I think 13 of 16 from 1989 is a pretty good track record. For that matter, 9 out of 14 (from 1988) is probably a better three-year survival rate than that of local computer stores selling true-blue IBM!

Walt Crawford
Redwood City, California

JUST CALL ME SAM

A noted celebrity once said that he didn't care what the media said about him as long as they spelled his name right.

In your January 15, 1991, review of menuing systems ("Type 'M' for Menuing Software"), some great things were said about *Automenu*. We at Magee were quite pleased because we do care about what the media says. Just for the record, though, my name is Marshall, not Michael.

Marshall Magee, President
Magee Enterprises
Norcross, Georgia

UNFAIR TREATMENT

In John C. Dvorak's "Comdex: Just Say No" column (February 26, 1991), I think the title is really misleading, since Mr. Dvorak devotes 40 percent to his frustration with the airplane, and another 15 percent to the frustrations of parking. This is the basis for an article about the industry's biggest event? Give me a break!

T. Kirby Lindsey
La Mirada, California

IN LIMBO IN APO

In the January 15, 1991, Advisor column, you printed a letter from a Sgt. John Meyer of "APO, New York." He was looking for a utility and you suggested he download it from PC MagNet.

I don't know the Sergeant, but we have one thing in common: We can't access PC MagNet, because we can't dial 800 numbers. Why? APO, New York, isn't on any map; it isn't a place. It's an army or air force post office box, usually for people stationed in Europe or Saudi Arabia. It isn't possible to dial 800 numbers from outside of the U.S., so we can't access toll-free technical service lines either. Mail-order vendors seeking to sell items to individuals with APO addresses should be prepared to return overseas telephone calls. Many won't. As a result, these companies stand to lose many customers.

Ralph Lohmann
APO, New York

CORRECTIONS & AMPLIFICATIONS

In our December 11, 1990, review "Fax Line Managers: The Electronic Call Director," the wrong photo accompanied the review of the VSI Faxswitch II. The product has since been replaced by a newer model, the Easy-Connect line sharer.

In our evaluation of DR DOS ("DR DOS 5.0: The Better Operating System?" February 12, 1991), it was stated that MS-DOS is not ROM-executable. A ROM-executable DOS, Version 3.22, has been available to OEMs since October 1989.

In our February 26, 1991, First Looks section, we should have stated that *Clip-Art Window Shopper* lists for \$49.95, which includes an on-line account for one year; there are no on-line charges. For subsequent years, the subscription renewal fee is \$35.

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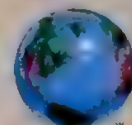


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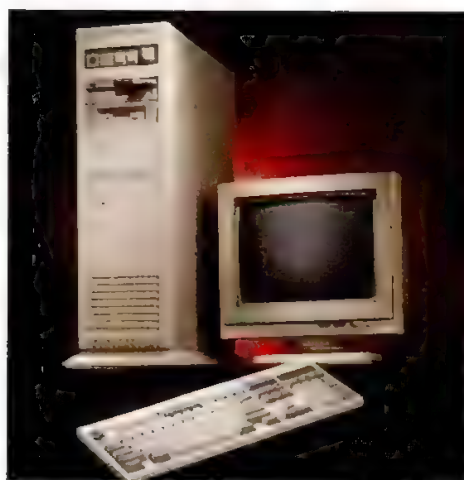
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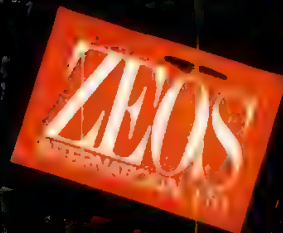
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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Intel Trims Math Unit from 486 to Create 486SX, Trims Prices Across the Board

Intel may have a virtual monopoly on the market for personal computer processors, but that doesn't mean the company is complacent.

It has asked a federal judge to prevent AMD from using the 386 name in marketing a processor (it was turned down), and it continues a long-standing suit that asks the courts to make AMD stop selling Intel microcode (the case is currently pending).

Since the courts don't seem to be ready to help, Intel's about to try a combination of economics and engineering. That means introducing a new product—the

486SX—and sharply reducing the cost of existing processors.

The Intel 486SX is unlike the 16-bit version of the 386 processor; the 486SX is a 32-bit device inside and out.

The only difference between a 486 processor and a 486SX processor is math coprocessing. The SX includes the 8K on-chip cache, 32-bit burst mode operation, and memory-management unit that make a 20-MHz 486 processor achieve 16 mips, but the SX leaves out the floating-point coprocessing unit.

Since few software programs benefit from a math coprocessor—outside the compute-

intensive realms of statistical analysis and engineering—that means the 486SX represents even less of a compromise than the 386SX did.

Intel is being careful not to undercut its high-end 486 devices with this move; only a 20-MHz version of the 486SX is being offered.

That's just half the speed of AMD's AM386, but Intel is pricing its chip at \$269 each (in thousand-unit quantities): \$37 less than AMD's asking for its 40-MHz processor.

Intel's still counting on the fact that systems designers don't shop for bargains when they buy processors, but the company is also reducing prices across the board on 386s and 486s, with cuts ranging from 20 percent to 50 percent.

What Intel is hoping to do is drive market demand up to 486-

level processors so that programmers will get serious about 32-bit software. Until such programs appear, there's only a modest 10 to 20 percent improvement in using a 486 over a 386 at the same speed (thanks to the on-board cache), even when running advanced 16-bit software like *Windows 3.0* and *OS/2 1.3*.

Intel claims that when software uses 32-bit instructions, a 486 (SX or DX) will outperform a faster 386 by great lengths, perhaps even at double the rate (thanks to internal 32-bit memory management that's not found in the 386).

On a 32-bit computational-intensive test, Intel says a 33-MHz 486DX will achieve 27 mips, a 33-MHz 386DX will achieve 11.4 and a 20-MHz 486SX will fall in the middle, reaching 16.5 mips.

It may be a couple of years before there's enough 32-bit software to justify the switch from a faster 386 to a slower 486SX. If Intel convinces the right people, however, it could be a shorter wait.

In the meantime, Intel will have to make the difficult argument that a faster clock rate doesn't always mean faster performance.

A Multimedia Standard Begins to Get Serious

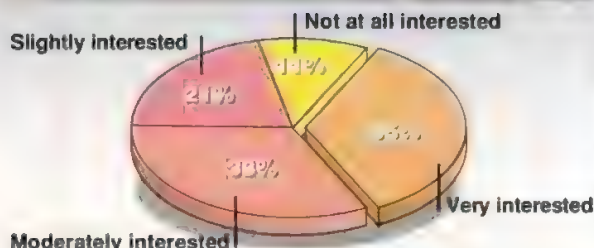
After years of talk, software publishers and systems manufacturers are about to deliver multimedia products of every style and sound.

Microsoft, of course, is hoping to steer the onslaught. Last year, it began to share with developers the code for multimedia extensions to *Windows*, and now many of these companies are prepared to enter the market. One of the remaining obstacles is the delay in shipping *Windows*

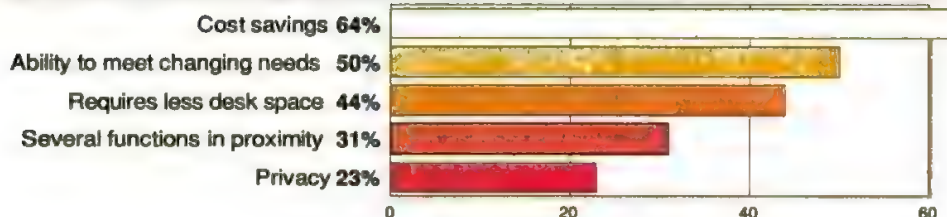
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SURVEY

What's your level of interest in a multifunction peripheral?



Which benefits would you say were very important?



Call it what you will—a multi-function peripheral, a hydra—it doesn't have one specific name yet, but it's being developed. What is it? A device that combines plain-paper fax, laser printing, copying, and graphics scanning.

The efficiency of sharing components appeals to manufacturers, but it's not yet certain whether users will be interested.

We asked 1,083 callers to PC MagNet about the concept. When we asked them to rank the potential benefits of such products, it was clear that people perceive multifunction peripherals as a way to bring down costs.

Pipeline

CONTINUED FROM PAGE 27

3.1, which Microsoft had targeted as the release point for the technology.

Undeterred by this niggling detail, a slew of companies are announcing products under the umbrella of a new logo that Microsoft is promoting. Called MPC, for Multimedia PC, the logo is intended to assure consumers that a product will work with other multimedia products.

Anyone who's followed the development of multimedia will recognize MPC compatibility as "Level One Multimedia"—the minimum configuration Microsoft has said would be needed to generate acceptable sound and graphics on a PC. It includes a processor running at 10 MHz or faster, at least 2MB of RAM, a hard disk of at least 30MB, VGA or better, digital audio (preferably MIDI-compatible), and a High-Sierra-compatible CD-ROM player.

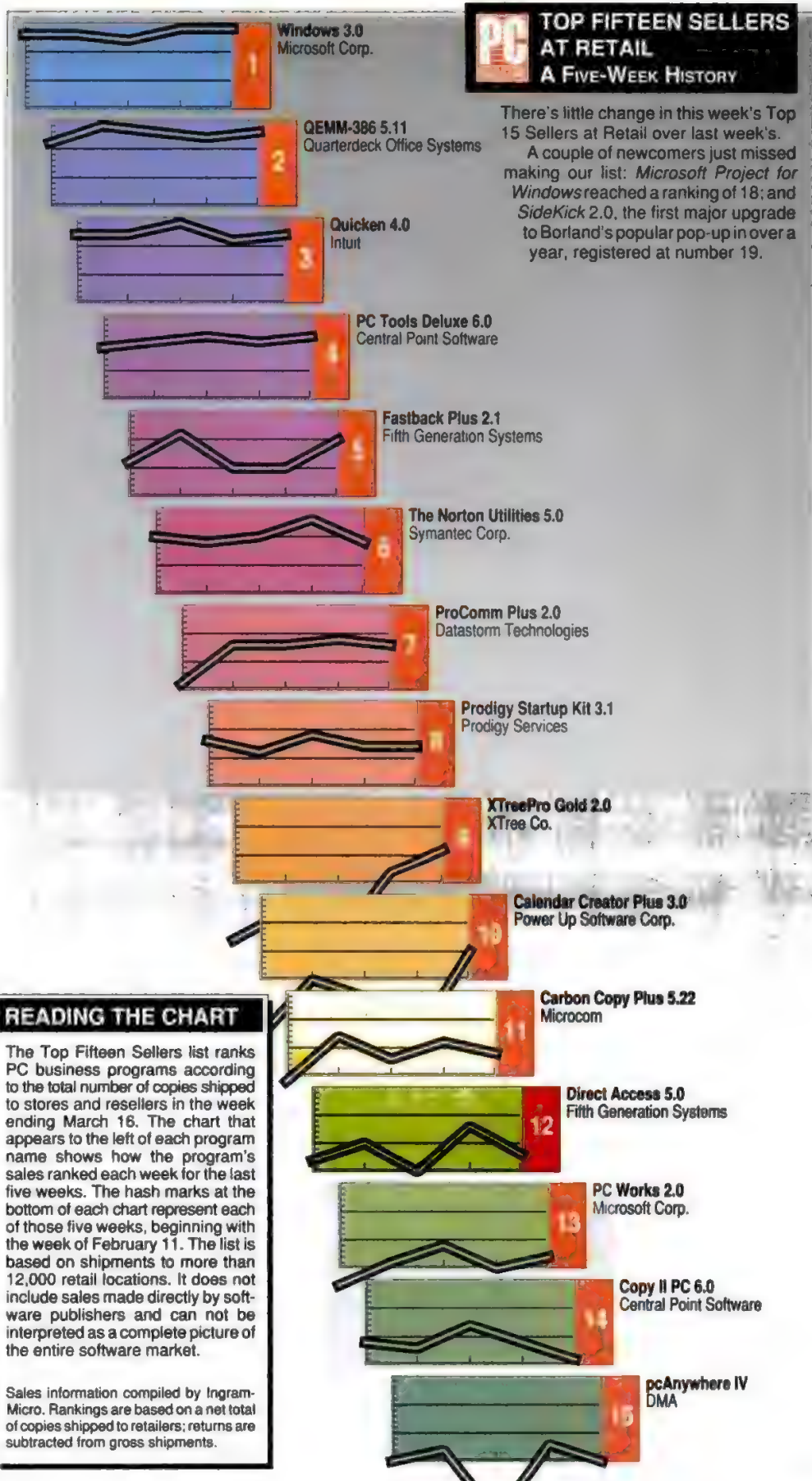
There are 11 hardware vendors who've signed on to use the MPC logo: Tandy, Zenith, AT&T, Creative Labs (who make the popular Sound Blaster board), CompuAdd, Fujitsu, NEC, Media Vision, Philips Consumer Electronics Co., Video Seven, and Olivetti.

And Tandy is selling the first CD-ROM player optimized to display video animation (it uses a proprietary interface, rather than SCSI, for a faster data transfer rate).

Among the software publishers who've been willing to talk about their works in progress are Sierra (with a talking *Mixed Up Mother Goose*), Compton's (with a *Windows* version of its encyclopedia), and Hewlett-Packard (with object-oriented development tools).

Without disclosing its precise plans, Microsoft has been buying the software adaptation rights to established reference books, including *The AMA Encyclopedia of Medicine*, *The Way Things Work* by David Macaulay, and *Your Baby and Child* by Penelope Leach.

Look for a noisy Christmas in the After Hours section. ■



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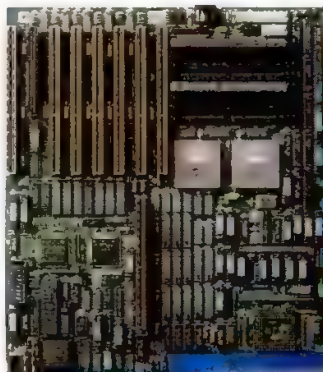
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First Looks

Hands-on Reviews of the Latest Products

HP's 95LX: Palmtops Get Real

HANDS ON
by Jonathan Matzkin

Early palmtop computers were little more than toys. They didn't support DOS, had tiny displays, and most of them had awful, alphabetically arranged keyboards. Over the last few years palmtops have become more PC-like. They've assumed their rightful place as DOS workalongs—convenient, pocketable data containers.

HP's staggeringly small 95LX heralds a new era for the lowly palmtop. This minuscule marvel brings a substantial measure of PC functionality to your pocket or palm, at a \$699 price that ought to have competitors gasping for air. It doesn't do everything that The Poqet PC does, and it lacks the Poqet's true compatibility, but at less than half the price, the 95LX is definitely at the head of palmtop class.

The unit is based on the 8088-compatible NEC V20H processor, and holds DOS 3.22 and a suite of sophisticated built-in applications in 1MB of ROM. It ships with 512K RAM—with about 250K devoted to a RAM disk that can be addressed as C:, just like a virtual hard disk—and it runs on two AA batteries. Its QWERTY

keyboard is too small for touch typing, but reasonably fast text entry is possible with a two-fingered approach.

Like many of the smallest systems, the 95LX supports credit-card RAM and ROM modules that plug into a card drive. They are available in 128K (\$199.95) and 512K (\$399.95) sizes. The 95LX's RAM disk provides enough storage for a meaningful number of files, but at the expense of user RAM. With an add-in RAM card installed, you can shrink the RAM disk to as little



The 95LX houses a suite of desktop apps and a full-blown version of 1-2-3.

PC MAY 28
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as 30K, leaving most of the 95LX's 512K for the user. However, the high price of the add-in cards will probably be a deterrent.

Though the 95LX will run some DOS software, its built-in apps provide enough functionality to keep most users happy. The special version of *Lotus 1-2-3*, Version 2.2, (see sidebar "1-2-3 in the Palm of Your

CONTINUES ON PAGE 34

Lotus Notes, Version 2.0: Connectivity and New Pricing Broaden Its Appeal

HANDS ON
by Sally Blanning DeJean

Lotus Notes users are a zealous group who swear that the program "transforms" their organizations. But in reality, the high cost of maintaining *Notes* resources and the limitations of its flatfile database structure have kept it far from general public acceptance. The difficulty of using *Notes* from a remote laptop, the need for qualified support personnel to develop

applications and maintain the servers, limited access to other e-mail systems, file size limitations, and the lack of math functions in its views, headed a list of complaints that simmered in the *Notes* community.

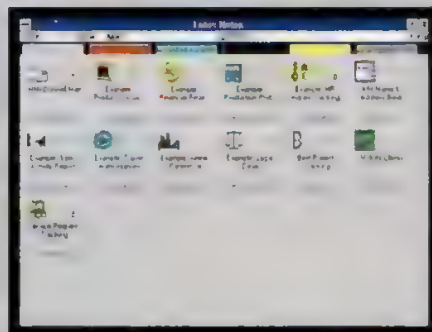
Notes 2.0 eliminates many of these stumbling blocks. It offers a more reasonable pricing strategy, better remote dial-in access and better imaging, along with new expanded connectivity features. In addition, it offers stronger document repli-

cation and administrative functions, as well as DDE and OLE support, field and document level encryption, and many improvements to the forms, filters,

and views—the backbone of its database applications.

In some ways, Version 2.0 doesn't go quite far enough. It doesn't address the limitations

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Notes has a sharper-than-ever image. A redesigned workspace houses more icons, boxes with database information, and an improved menu bar.

First Looks

HP 95LX

CONTINUED FROM PAGE 33

Hand'') will steal the limelight, but the 95LX's other apps are definitely worth a closer look. As with *1-2-3*, they execute in ROM, with data loaded into conventional RAM. The ROM executability of these built-in apps stretches the 95LX's RAM much further than it would normally go, even with a fairly large RAM disk configured.

When you press the 95LX's "on" button, its 8-line by 40-character MDA screen is given over to a title graphic with the invitation to "press a blue application key . . ." Sure enough, each of the built-in apps (file manager, communications,

phone book, memo pad, *1-2-3* or calculator emulator) has a corresponding blue-colored key.

What's more, the blue keys not only launch the applications, they context-switch them as well. Need to jot down a quick note while working on a spreadsheet? There is no need to close the current file. Tap the blue key for the memo pad, write your note, and then simply tap the *1-2-3* key to resume work on your spreadsheet, exactly where you left it.

This integrated desktop "environment" is further enhanced by the 95LX's clipboard, which allows you to move data among the different apps, including *1-2-3*. The individual applications share a command line menu structure that *1-2-3* users are bound to find instantly fa-

miliar. Regardless of which app you are in, a tap of the Slash key pops up the application's main menu.

While none of the built-in apps will make you forget about your desktop machine, they are surprisingly powerful. The memo pad supports files of up to 51K, according to HP; other apps handle files of similar size. The comm application supports standard Hayes-compatible modems, and offers a rudimentary scripting capability for one-touch log-on to e-mail or information services.

The appointment book offers daily, weekly, and monthly calendar views, and supports repeating appointments. And, as is appropriate for a system with its parentage, the 95LX is also a powerful calculator. It emulates much of the functionality of

HP's popular HP 19B, and offers a host of options, including your choice of RPN or algebraic notation.

Despite the rich functionality available from the built-in applications, some users will want to work from the standard DOS prompt. Off-the-shelf DOS software will run on the 95LX, as long as it can cope with the limits imposed by the screen, the palmtop's MDA display adapter, and available RAM. To return to a DOS C:\ prompt from the "desktop" shell you simply choose "System" from the file manager's menu. CHKDSK reported roughly 172K RAM available with the RAM disk sized to 254K.

In addition to everything else it offers, the 95LX has a very definite "gee whiz" component, in the form of infrared communications (sans cables of any kind) between two of the units. That's not of primary interest to DOS users who will be more interested in modem or file-transfer communications with PCs (a file-transfer cable with desktop software is available for \$99.95), but things could get interesting if HP designs an infrared link between the 95LX and some of HP's own printers. How's that for hassle-free output?

Obviously no system as small as the 95LX can replace your laptop, or your desktop for that matter. On the other hand, your larger systems don't fit very comfortably in your pocket, do they? ■

1-2-3 IN THE PALM OF YOUR HAND

by Craig Stinson

The screen is large enough to show A1 through D11. The tiny keyboard defeats efforts at touch-typing. Memory constraints may force you to leave big worksheets at home. But yes, the 95LX does put an almost complete version of *Lotus 1-2-3* in the palm of your hand.

What you get is both a little less and a little more than the standard Release 2.2. Let's begin with less: *Allways* and the Macro Manager Library are omitted, and other add-ins work only if they can run in conventional memory and use an MDA screen. Macros that depend on 80-by-25 screen dimensions for navigation will need to be altered. The Help messages have been pared down, and PrintGraph and Translate have been eliminated. There's no support for EMS or a coprocessor.

In return for these sacrifices, you get portability, a backsolver, and a clipboard. The backsolver, supplied via the Financial Calculator application and smoothly inte-

grated with the *1-2-3* module, lets you adjust an input cell automatically to produce a desired output-cell value. You set up your problem in *1-2-3*, switch to the calculator, and issue simple menu commands. When the calculator prompts for the variable cell, it switches back to the worksheet to let you point to it. A couple more strokes and you're back in *1-2-3* with your solution in place.

The clipboard, available in all 95LX applications, lets you pass information between your spreadsheet and your calendar, phone book, or memo writer.

Because the small screen makes labels and data points on a graph overlap, the 95LX version of *1-2-3* also includes a graph magnification feature. Repeated zooms increase the graph to a maximum of four times its normal size.

Using the 95LX keyboard for *1-2-3* takes adjustment. The alpha keys, function keys, and keypad numbers are laid out normal-

ly, but everything else is not. The indispensable @ is on a key by itself, but Home, End, PgUp, and PgDn are all shifted keys—an inconvenience that will impede your travel around the worksheet.

With the standard memory configuration—512K divided almost equally between normal RAM and a RAM disk—you'll have about 109K available on a blank worksheet (with Undo off). An optional 512K memory module lets you reduce the RAM disk to as low as 30K, at which point *1-2-3*'s Status command will report about 333K available. These limits rule out large consolidation worksheets, long-range planning models, and database applications. But you can take a lot of 15K worksheets on the road, even without the memory expansion.

In the early 1980s, *1-2-3* was the application that validated the purchase of personal computers. Now it looks like Lotus may perform a similar feat in the palmtop world.

**FACT FILE**

HP 95LX
Hewlett-Packard Co., Corvallis Division, 1000 NE Circle Blvd., Corvallis, OR 97330; 443-1254.
List Price: \$699, connectivity pack, \$99.95.
In Short: DOS compatibility, an integrated suite of palmtop applications, a usable keyboard, a special version of *Lotus 1-2-3*, and a reasonable price: The HP 95LX has all the ingredients to make palmtop computing a reality.

CIRCLE 712 ON READER SERVICE CARD



Via DDE, **Notes** integrates documents from other **Windows** or **OS/2** apps. Double-clicking on **Notes'** DDE linked text launches **Word**.

Lotus Notes

CONTINUED FROM PAGE 33

of **Notes'** flatfile superstructure. Users still have no relational capabilities. They cannot join databases or do full text retrievals across databases.

Still, the improvements are laudable. Enhanced remote workstation and laptop communications means that users no longer have to be connected to **Notes** while composing e-mail messages. Other features such as a pop-up address book and in-

telligent mail routing improve **Notes'** built-in e-mail, and Lotus' recent purchase of **cc:Mail** promises to extend its range.

Notes continues to protect data with tight security. Each individual gets a **Notes**-generated ID and special "certificates" based on RSA dual-encryption key technology. Version 2.0 adds security at the field and document level with another form of encryption key. Users can create a new document, and the encryption keys to go with

WHAT'S IN A NOTE?

Notes creates a setting for groups of people to collaborate, share, and organize information, and to act upon it in a collective way. Using group communications and database application features in a highly secure environment, **Notes** offers a platform for developing its own applications as well as integrating other applications.

Using forms and views, which bear a resemblance to records and reports in databases, **Notes** applications are designed to track projects and clients, handle forms processing, disseminate newsletters, handbooks and manuals, or allow users to participate in discussions and development projects. Since all applications share common commands and interfaces, users can switch from one **Notes** application to another without having to learn multiple applications.

Notes, which runs on

many NetBIOS-compatible LANs or WANs, is based on client/server technology. Its servers run under OS/2, its workstations under OS/2 or **Windows 3.0**. **Notes** regularly replicates the databases to keep databases on different servers in sync with each other. The servers dial each other and compare individual documents, updating any changes.

In Version 1.0, when a document was edited by two users, **Notes** replicated the edit with the later timestamp, and discarded any others. In contrast, when **Notes 2.0** encounters several edits to a document, it finds the edit with the most extensive changes and makes it the main document. All others are identified with a diamond symbol and listed as response documents. The database manager can then choose which version to save.—SBD

NOTES ON THE MARKET

When, after a five-year development effort, Lotus introduced **Notes** in December 1989, it aimed its sales efforts toward organizations whose management strategy involved cultivating teams to make decisions through shared expertise.

Currently 75 customers have more than 35,000 **Notes** users. Through its direct sales force Lotus sells **Notes** for \$62,500 in quantities of no less than 200 units.

Realizing that small companies are also good candidates, a number of VARs sell **Notes** in smaller units. Depending on the level of support, four or five

units might cost as little as \$10,000.

Lotus continues to support their Alliance Partners. Simpact Associates adds voice annotation. **First!** from Individual and **News-Edge** from Desktop Data offer a live-feed newswire into a **Notes** database. Touch Communications and Soft Switch create gateways to other e-mail systems, and **Hoover** from SandPoint Corp. sends selected data into **Notes** from on-line databases. Others such as **Quality at Work**, from Quality Decision Management, offer applications geared toward specific businesses.—SBD

it. Encrypted fields are not visible to those without the key.

The 64K limit for an image stored in a rich text field has been increased to four gigabytes, which **Notes** compresses for storage. There's new support for PCX and TIFF imports, and the size limit of a database has expanded from 40MB to 100MB.

Notes also adds paragraph styles and tables, mail-merge, increased color, some limited math functionality, SAA/CUA compliance, six new @ functions, and many administrative features such as easier setup and user ID creation.

The program's potential as a platform for integrating applications lies in its local and wide area networking capabilities, its API language for developing gateways to mainframes and other kinds of programs, its inclusion of DDE and OLE, and its ease for the end user. Still, integrating so many processes is difficult and intricate.

Notes offers a relatively easy system for end users, but developing and managing applications is often a more complicated process than Lotus wants to admit. Organizations willing to commit the resources in personnel and hardware will be well rewarded; those who buy but can't support the program will be disappointed. ■



FACT FILE

Lotus Notes, Version 2.0
Lotus Development Corp., 55
Cambridge Pkwy., Cambridge,
MA 02142; 617-577-8500.

List Price: \$62,500 for 200 licenses (includes 6 months of support and maintenance). Additional licenses for \$395 each. Quantity discounts available.

Requires: For server: 386-based PC or better running OS/2 SE or EE 1.2 or later, 6MB RAM (9MB recommended), 60MB hard drive (130MB recommended), OS/2-compatible monitor, asynchronous communications port, network hardware that is LAN Manager/NetBIOS-compatible. For workstation: 286-based PC or better running OS/2 or **Windows 3.0**, 4MB RAM for OS/2 users (2MB minimum for **Windows** in Enhanced mode), network adapter card, 40MB hard drive recommended, mouse.

In Short: A powerful group communications platform, **Lotus Notes** improves remote access, enhances security, expands graphics support, and provides better integration with **Windows** products. Still, **Notes** remains sufficiently complex. Despite the new pricing strategies, the program demands a fervent commitment in time and resources.

CIRCLE 488 ON READER SERVICE CARD

First Looks

Nickel Hydride Extends Battery Life, but T2000SX Could Be Trimmer, Faster

HANDS ON
by MMT Jones

With its T2000SX, Toshiba has designed a 16-MHz 386SX-based notebook that needs no apologies for its battery life—about 3 hours—or its LCD—which finally migrated from double-scan CGA to VGA.

The base model carries a list price of \$4,999 and comes with 1MB RAM, a 2.5-inch Conner Peripherals 20MB hard disk, a 1.44MB floppy disk, DOS 4.01, and a full range of ports: one serial, one parallel, one external VGA, one expansion, and a connector for the \$99 external numeric keypad. A jump in price to \$5,499 gets you the 40MB Conner hard disk.

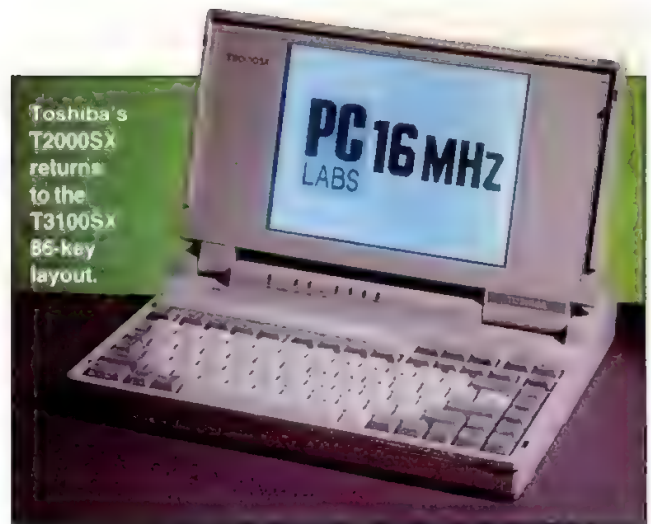
As with past Toshiba notebooks, system memory is expandable to 9MB via a slot that accepts 1MB, 2MB, 4MB, or 8MB credit card-sized RAM modules. This 6.8-pound machine (1.9-by-12.2-by-10-inches) will be familiar to Toshiba notebook users, but is larger than the trim Compaq LTE or TI

TravelMate 3000.

Toshiba received a walloping 3 hour and 7 minute score on the PC Magazine Labs battery rundown test—in part by using nickel hydride instead of the nickel cadmium batteries.

Theoretically, nickel hydride bolsters capacity per unit weight by 50 to 100 percent over nickel cadmium; it also recharges more quickly. In this first application, results are more modest: Toshiba reports that the material provides about 22 percent more capacity per unit weight over nickel cadmium. As for recharge time, the 1.6-pound removable battery requires a minimal 1.5 hours for a full charge when the machine is off, but it cannot be recharged at all when on. Another drawback, at least until manufacturers begin using the batteries in quantity, is price. Spare packs for the T2000SX, which are rated at 2.2 Ah, list for \$229.

The T2000SX's 16-shade VGA display is an improvement over the double-scan CGA of the past, but its black-and-white



display was a bit disappointing when compared with the best of its competition. Toshiba does a nice job of keeping ghosting and bleeding to a minimum, but the "white" background never transcends a greenish light blue, and the text fell far short of a crisp, well-defined black. In all, the display is usable, but less than exceptional.

Other features, such as the idiot-proof AutoResume mode found in all Toshiba notebooks, make a welcome appearance here. The keyboard is also excellent. Toshiba used the 86-key layout of the 15-pound T3100SX, plus five dedicated keys above the function keys toward the right: NumLock, ScrollLock, Pause, -, and +.

Toshiba sells a comprehensive list of options including an

80387SX math coprocessor; some incredibly expensive memory cards ranging in price from \$549 for the 1MB version to \$3,999 for the 8MB card; and two internal 2,400-bit-per-second modems—a basic version for \$349 and a V.42bis MNP Level 5 version that's cellular-capable, which lists for \$449. The company has also added the \$1,199 Desk Station II, a desktop docking station with two full-sized 16-bit slots.

Had the Toshiba T2000SX a crisper, brighter display and a 20-MHz processor, it might be a difficult machine for any red-blooded computerphile to resist. But right now the question is: Does its excellent keyboard and sturdy construction outweigh its oversized notebook chassis and heady pricing? This will likely be a tough decision for many prospective buyers. ■

BENCHMARK TESTS: TOSHIBA T2000SX

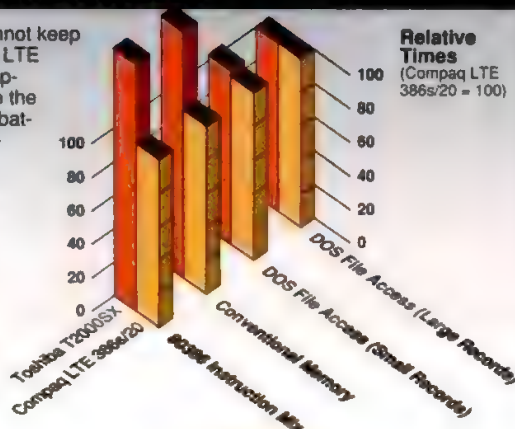


At 16-MHz, the Toshiba T2000SX cannot keep pace with the faster 20-MHz Compaq LTE 386s/20. Its processor performance is unexceptional even for a 16-MHz SX notebook. Where the T2000SX shines is in its 3 hour and 7 minute battery life and strong video performance (not reported here).

■ The 80386 Instruction Mix benchmark test times a series of tasks specific to the 80386 chip. This test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture.

■ The Conventional Memory benchmark test measures the read/write speed of the first 640K of memory. Slower times can indicate the presence of memory wait states or memory chips rated at slower access speeds.

The DOS File Access (Small and Large Records) benchmark tests time disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. These tests are performed without software disk caching. In addition, the large record segment of the test minimizes the effect of small hardware caches on disk subsystem performance.



Performance Times (Times given in seconds)	80386 Instruction Mix	Conven- tional Memory	DOS File Access (Small Records)	DOS File Access (Large Records)
Toshiba T2000SX	4.56	0.66	62.91	5.91
Compaq LTE 386s/20	3.09	0.45	60.60	5.89



FACT FILE

Toshiba T2000SX

Toshiba America Information Systems Inc., Computer Systems Division, 9740 Irvine Blvd., Irvine, CA 92718; 714-583-3000.

List Price: With 1MB RAM, 20MB hard disk, 1.44MB floppy disk drive, VGA LCD screen, one parallel and one serial port, DOS 4.01, \$4,999; with 40MB hard disk, \$5,499.

In Short: This 16-MHz 386SX-based portable builds on the same form factor as past Toshiba notebooks but extends battery life and adds a competent, if somewhat lackluster, VGA display.

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First Looks

HP's LaserJet IIIP Brings PCL5, Resolution Enhancement to Low-Price Laser Printing

HANDS ON
by Edward Mendelson

Once a year, like clockwork, Hewlett-Packard releases a new printer that costs less, does more, and performs better than anything fielded by the competition. This year HP has done it twice—first with the 17-page-per-minute LaserJet IIISi for the network market (see First Looks, April 16, 1991), and now with the superb \$1,595 LaserJet IIIP, which redefines the low-end laser printer market.

Measuring a mere 14 by 16 by 8 inches high, and weighing 22 pounds, the 4-page-per-minute IIIP looks like the LaserJet IIP, but it adds the same resolution enhancement technology and PCL5 scalable fonts built into the 8-ppm LaserJet III. In addition to the familiar bit-mapped Courier and Lineprinter fonts found in all LaserJets, the IIIP adds Agfa Corp.'s CG Times and Univers typeface families in any size up to 1,000 points. At a probable street price of around \$1,000, the IIIP will bring high-speed, high-resolution scalable fonts to users who could never afford them before.

A single cartridge slot lets you add any standard bitmap or scalable font cartridge that

works with the LaserJet III. Or you can choose to install HP's Adobe-licensed PostScript cartridge, which transforms the IIIP into a 4-ppm true PostScript printer. The printer comes with 1MB of RAM, which means you'll have to add RAM to meet the 1.5MB requirement for the PostScript cartridge. You'll also need a 1MB RAM boost to print a full page of 300-dot-per-inch graphics, although the printer can manage about three-quarters of a page of graphics without an upgrade. The two RAM card slots in the IIIP accept the same memory boards available for the older IIP and III, and let you install up to 5MB total RAM.

The weakest feature of the IIP was its limited paper capacity—only 50 sheets in the built-in tray. The IIIP improves matters, but only slightly, by accepting 70 sheets. The new model lets you add the same optional 250-sheet lower tray (\$195) already available for the IIP. The lower tray not only increases total capacity beyond even the 200-sheet capacity of the LaserJet III, but also lets the IIIP act as a dual-bin printer like the bulky LaserJets IID and IIID.

You can place letterhead sheets in the internal tray and second sheets in the lower tray, and have your software automatically switch between them. *WordPerfect* is especially adept at this switch. If your software doesn't have a IIIP driver, you can get full font and paper-handling support from a IIID driver.

Some of the improvements in the IIIP over the IIP are invisible. The new model uses a 16-MHz Motorola 68000 processor; the old one used a 10-MHz chip. The new model took only 35 seconds to print the graphics sample in *PC Maga-*



zine Labs benchmark tests, while the IIP took 53. (Both models printed text at 3.9 ppm.) A new parallel port accepts data at 55K per second, compared with a mere 10K per second in the IIP—and 15K per second in the III. The faster port means you can regain control of your computer faster with the IIIP than with competing models, although you won't see much practical difference if you use a software print spooler.

The IIIP's toner cartridge (replacements cost \$95) is rated at 3,500 pages—surprisingly close to the 4,000-page rating of the much larger cartridge used by the LaserJet III engine. The IIIP in fact uses the same cartridge as the IIP. HP doesn't like to talk about it, but the print en-

engine utilized in the IIP and IIIP actually produces slightly darker and clearer output than the faster and more costly LaserJet III. Essentially, if you care about print quality, and you don't care much about the better speed and two cartridge slots in the III, you'll be better off saving money and buying the new LaserJet IIIP.

The IIIP will change the low-end printer market in one other more subtle way. HP will continue to sell the earlier IIP in the United States at a list price of \$1,295. Still one of the best laser printers on the market, the IIP will now cost less than many dot matrix models. HP's low-priced, high-quality printers may at last bring the noisy dot matrix era to a quiet end. ■

UPGRADING OLD LASERJETS: Is It Worth the Price?

If you own a printer in the LaserJet II family, and find yourself growing fangs of envy over the clear output and high-speed scalable fonts that your coworkers get from printers in the LaserJet III family, there's still hope for your printer. You may be able to get the advantages of the III without persuading your company to buy you a new printer.

Some corporations will upgrade a piece of equipment before they'll replace it. If your company works that way, consider getting HP's \$985 upgrade to the LaserJet II or \$995 upgrade

to the dual-bin LaserJet IIID. This dealer-installed upgrade replaces the old motherboard and turns the old-model printer into an exact functional match of the corresponding newer models—the III or IIIP.

HP doesn't have an upgrade for the IIP, but sometime this fall you'll be able to buy an HP PCL5 cartridge that will add built-in scalable fonts and the advanced graphics support built into the IIIP. The cartridge won't give you resolution enhancement, but the IIP's print engine does an excellent job without it.—EM



FACT FILE

LaserJet IIIP

Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; 800-752-0900.

List Price: \$1,595.

In Short: Resolution enhancement and PCL5 in a compact laser printer. An amazing bargain, and one of the finest printers on the market for low-volume use.

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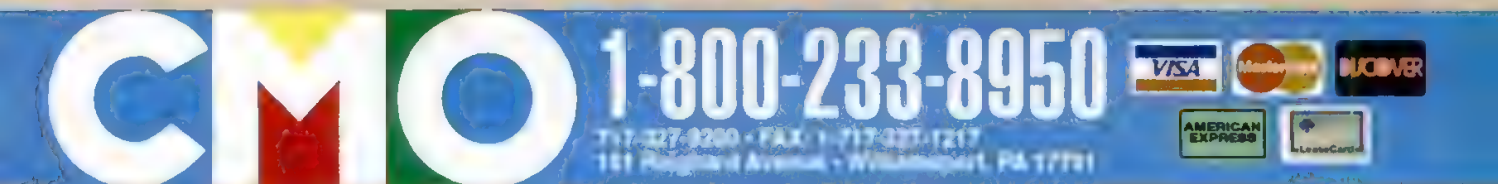
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First Looks

Quattro Pro 3.0: Beefs Up Presentation Engine, Adds WYSIWYG



With its as yet unannounced Windows spreadsheet still in the lab, Borland International has been busy keeping its DOS contender up-to-date. *Quattro Pro* 3.0 gives Borland "version-number parity" with Lotus and Microsoft. More to the point, it keeps *Quattro Pro* in the running for those who want a DOS spreadsheet with an optional graphical interface.

The centerpiece of *Quattro Pro* 3.0 is a display option called WYSIWYG that resembles PC Publishing's *Impress*, the graphical publishing add-in bundled with *Lotus 1-2-3*, Release 3.1, which is also called WYSIWYG.

Other highlights of the new version include a host of printing improvements, some valuable alignment features, plus the ability to generate three-dimensional "sculpted" objects such as buttons in the Annotator, and visual and aural transition effects for slide shows.

There's also a new Save All command, a useful item for those who keep multiple worksheets in memory, and an Auto-

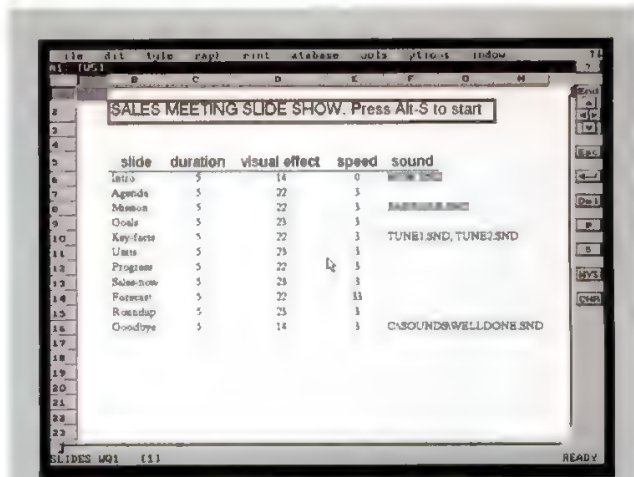
save Edits option to assist in graph generation. With Auto-save Edits turned on, *Quattro Pro* automatically saves each change you make to a named graph; you don't have to use /Graph | Name | Create again and again, as you do in 1-2-3. (The feature has one hazard, though. Unless you do use /GNC when you begin creating a new graph, the new one will overwrite your most recent named graph.)

The new WYSIWYG display completely replaces Version 2.0's Graphics Display option; macros that switch display modes will thus run unmodified in the upgrade. For spreadsheet publishers, the new graphics screen is a significant improvement over the old, because it shows fonts in their relative sizes and shapes and gives an accurate representation of underscores and borders.

Like 1-2-3's WYSIWYG screen, *Quattro Pro*'s can be zoomed up and down (from 25 percent to 200 percent) for varying degrees of panorama. Row heights may be adjusted and gridlines may be turned on or off. The default color scheme—black characters on a white background—can be modified to please any taste.

Unfortunately, along with new features come several vexations. Worksheets can be tiled and zoomed in WYSIWYG, but not overlapped. And if you switch from a tiled layout in a character-mode display to WYSIWYG, the current worksheet is zoomed—even though WYSIWYG is capable of tiling. On switching to WYSIWYG, the system insists on drawing each open worksheet in turn—even though it's eventually going to fill the whole screen with a single sheet. (The same redrawing occurs in Version 2.0, but it takes less time.)

Worse, the whole WYSIWYG screen is redrawn every



Quattro Pro 3.0's WYSIWYG screen features three-dimensional row and column headings and shows fonts and borders as they will appear in print.

time you delete or insert a column or row, move or copy data, or change a cell's format or font. These distracting and time-consuming redraws reduce WYSIWYG's suitability for everyday spreadsheet work.

On the printing front, the enhancements are solid and unequivocally welcome. *Quattro Pro* 3.0 includes two new features to assist in copy fitting. A Print to Fit command automatically scales oversized output down so that it fits on a single page—provided it can be done, of course. (The program actually goes a little overboard with a very large print block, reducing it beyond legibility.) A Percent Scaling command lets you reduce the size of your printout by a specific factor—anything from 1 percent to 100 percent.

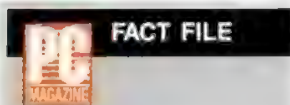
Those with dot matrix printers may now take advantage of a Banner command, which causes *Quattro Pro* to emulate Funk Software's hugely popular *Sideways* utility. In banner mode, a wide print block is output as a single page across the folds, sparing you from having to paste pages together. For the benefit of LaserJet users, Version 3.0 uses PCL commands to create shading. With any kind of printer you can now save orientation settings along with worksheet data. The Print menu has a new feature, a Copies setting that lets you generate multiple copies with a single command.

Quattro Pro's Annotator now includes alignment-grid options in order to assist with object placement. It also offers a handy set of commands that automatically align a group of objects with one another.

And for slide-show presentations, *Quattro Pro* now offers 24 visual transition effects, including wipes, dissolves, barn doors, irises, and stripes. To use these effects, you simply add an additional column to the slide table. In another optional column, you can specify the transition speed. For further pizzazz, you can embellish the transitions with sound effects. The *Quattro Pro* disks come with three digitized sound files, and more are included in *ProView Power Pack*, which is Borland's collection of presentation enhancements.

Meanwhile, back on the spreadsheet grid, everything is just as it was. *Quattro Pro* remains a lean, versatile, fast-calculating spreadsheet, with superior file-linking capability, a more comprehensive function repertoire and macro facility than 1-2-3, the ability to display multiple worksheets at once, and smooth integration with *Paradox*. But the program's analytical power remains identical to Version 2.0.

If you use *Quattro Pro* for quality presentations, Version 3.0 is a must. If you use it mainly as a calculating engine, you can safely stick with 2.0. ■



Quattro Pro, Version 3.0
Borland International, 1800
Green Hills Rd., Scotts Valley,
CA 95067; 408-438-8400.
List Price: \$495; LAN Pack,
\$395; upgrade from 2.0,
\$49.95; upgrade from 1.0,
\$99.95; upgrade from
competing products, \$129.95.
Requires: 512K, DOS 2.0 or
later.
In Short: 3.0 brings marked
printing and slide-presentation
improvements. But its
WYSIWYG graphics screen is
disappointing and its basic
spreadsheet features are
unchanged.

CIRCLE 700 ON READER SERVICE CARD



Our Latest PostScript Printer Technology Impressed The Experts...



MacUser,
Editor's Choice Award
(Eddy), Jan. 9, 1991



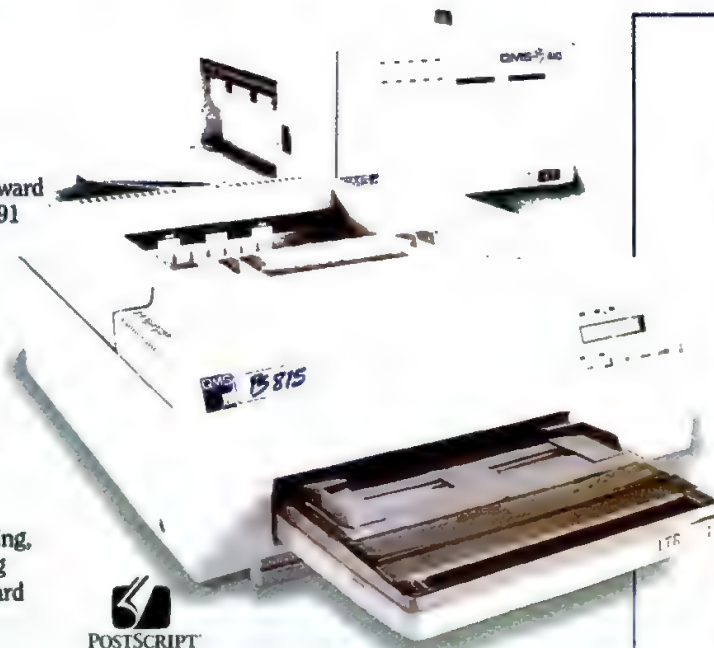
PC/Computing,
Most Valuable
Product,
Nov. 1990



BYTE,
Editor's Product
Merit Award,
Jan. 1991



Personal Publishing,
1990 Outstanding
Achievement Award



POSTSCRIPT

...So We Decided To Give Them More Of A Good Thing.

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QMS-PS 410, 815 & 825 PostScript Laser Printers

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- SIO-Simultaneous Interface Operation (allows the printer to receive data from three interfaces simultaneously)
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- 45 resident Adobe PostScript typefaces (all can be scaled from 4 points upward, rotatable, all with multilingual character sets)
- Front Panel Display on QMS-PS 815 & 825 (16-digit multilingual LCD array conveys printer status, allows user to quickly configure printer)
- Resident HP LaserJet Series IIP & PostScript emulations (prints PostScript & HP applications, HP-GL emulation cards available)
- QMS ASAP III Technology and 68020 Microprocessor (exclusive technology means fast first-page-out performance)
- PS Executive Series™ Utilities Software (to easily set printer parameters)

emulation cards, HP compatible font cards, memory upgrades and extended paper handling capabilities are all currently available.

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*patent pending

CIRCLE 164 ON READER SERVICE CARD

First Looks

Low-Cost Utilities Supplement Windows File Launching

HANDS ON
by Barry Simon

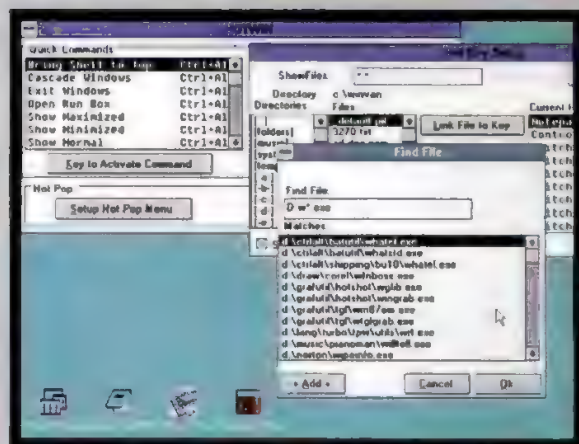
Programmers are starting to churn out useful utilities for the rich Windows environment; here are five valuable ones that all help launch applications. Two of them, *UpDown* and *Folder*, enhance Windows' Program Manager (ProgMan). Another two, *Usher* and *Hotwin*, are the best in a group of five or six supplements to ProgMan. They provide a quick and easy pop-up menu rather than the elaborate shells offered by programs such as *Command Post*, *Aporia*, and *hDC Express*. The last program, *Second Chance*, lets you associate file types with various programs.

UpDown and *Second Chance* are free (see sidebar), *Folder* and *Usher* are shareware programs that you can download or purchase and then register for continued use. *Hotwin* is a retail application. You can obtain the first four from PC MagNet's Utilities forum, Library

10, or shareware disk vendors.

The \$20 *Folder* makes ProgMan appear to have multiple levels of subfolders. With it, you can add folders to any ProgMan window. Double-clicking on the folder opens a window of icons from which you can launch applications. *Folder* isn't quite as transparent an extension of ProgMan as it might be: You can't add items to folders by dragging them from FileMan, and minimized folders reside on the desktop rather than in the ProgMan window. But it comes as close as you'll get to creating real subfolders for ProgMan.

The \$15 *Usher* lets you set up two pop-up menus that are invoked when you depress any button on your mouse, provided the pointer is over blank desktop space. The menu items can be submenus, items that launch applications, or a display of system information like date, time, and free memory. Because you need to set up the menus via a text file, this program is not for



Hotwin can assign an application to a hotkey using a dialog box. The dialog box includes a file-find module to locate the program you wish to assign.

complete novices.

My pick of the litter is the \$39 *Hotwin*. It provides a pop-up menu with one level of submenus, and has two special functions. A set of quick commands can be assigned to hotkeys. For example, a single stroke can cascade or tile all open windows, bring ProgMan to the top window, or even exit Windows. And you can assign an application to a hotkey with any key combination.

This incredibly useful program is still a little rough around the edges: It has poor documentation, no ability to assign parameters to launches, and no way to rearrange the menu choices, but it makes Windows a pleasure to use.

List Price: *Folder*, Version 3.1, \$20 shareware. **Requires:** Windows 3.0. Sloop Software, 6457 Mesedge Lane, Colorado Springs, CO 80919; 719-260-0433. Also available on PC MagNet.

CIRCLE 703 ON READER SERVICE CARD

List Price: *Hotwin*, Version 1.5, \$39. **Requires:** Windows 3.0. Abacist Software Co., 2815 Mission Blvd., San Diego, CA 92109; 619-488-3929.

CIRCLE 704 ON READER SERVICE CARD

List Price: *Usher*, Version 1.2, \$15 shareware. **Requires:** Windows 3.0. George Browning, 5124 Melbourne Rd., Raleigh, NC 27606; 919-859-3825. Also available on PC MagNet.

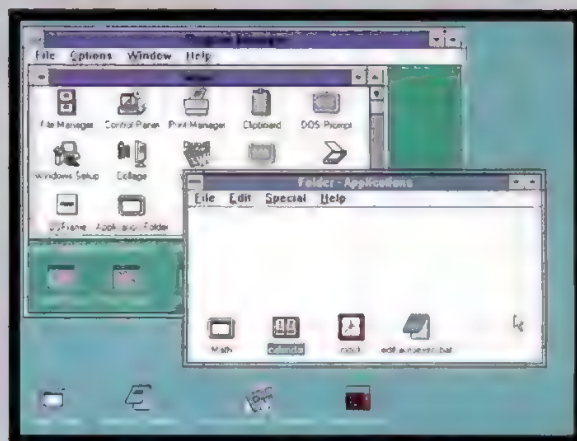
CIRCLE 705 ON READER SERVICE CARD

FILE LAUNCHING FOR FREE

UpDown, written by Bruce Adelman, is a free, simple, but useful expedient for controlling ProgMan (and optionally File Manager). When you launch a program from ProgMan or when you move the focus from ProgMan to another window, *UpDown* minimizes ProgMan. If you minimize and/or remove all other applications, *UpDown* will open ProgMan from its minimized state. The only problem I found was that if you had a program that was always open, albeit hidden (like *Usher*, discussed in the main story), then *UpDown* would never open ProgMan for you.

For those who've wished they could associate a file extension with two or more programs, there's *Second Chance*. This free program, written by Robert Heath, can, for example, associate *.DOC files with both *Word for Windows* and *Microsoft Word*. It allows you to specify extensions that invoke a special pop-up box where you can choose among the executables you wish to run on the selected file. It's a clever idea that meets an important need.

Both programs are available on PC MagNet in the Utilities forum, Library 10.—BS



Folder produces launchers that look like Program Manager windows and act like second-level subgroups.

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CIRCLE 141 ON READER SERVICE CARD

First Looks

Mind's Eye: Object-Oriented Database with an Expert Twist Needs Polish

HANDS ON
by Richard Hale Shaw

Mind's Eye is a different kind of data manager, culling its feature set from a variety of established application genres. Unlike a traditional PC database management system (DBMS) where each table contains records of the same kind, *Mind's Eye* lets you mix differently structured records alongside one another.

Like Borland's *Object-Vision*, it can be used as an object-oriented application development tool for creating hypertext/graphical applications—no programming required. The \$695 DOS-based package can also incorporate both text and graphics into a single database record. And, like an expert system, it can show the relationships between objects. Putting these pieces together, *Mind's Eye* is a unique object-oriented database that incorporates many elements found in expert systems.

The product uses its own jargon. For example, you create "projects," not applications. Each project is composed of objects (records) that can contain

any type of data. There are four object types: primary (all-purpose) objects, class objects (whose features are inherited by other objects), figure objects for keeping pieces of complete images, and auxiliary objects that provide alternate views of primary objects.

For example, an auto inventory project might contain objects with information about cars and car parts, including prices, sources, bought and sold transactions, and customer information. These can include text descriptions and color images of car parts, stored as auxiliary objects, and attached to primary objects (in this situation, the car part).

Objects are linked via their attributes (fields), which describe the object, store the object's data (text, numbers, currency, and dates), establish relationships and links to other objects, and derive the data via the relationships whenever necessary.

When you open a project, the interface displays a project tree depicting all the objects and their hierarchical relationships to one another. You can navi-

gate through the information by clicking on the various branches of the tree. *Mind's Eye* visually indicates unification (the state of the relationships) by color coding. Thus, a blue object's unification state is "loose," indicating that it doesn't require data from other objects; a red object is "nonunified," indicating that a problem among the objects prevents it from deriving the required data. For example, a car part might show up in red if it were stocked in insufficient quantities. In *Mind's Eye* derived information can be built into the data descriptions; in a traditional DBMS, this information has to be programmed.

Mind's Eye has no database language. Instead, as with some expert systems, you establish the relationships between various objects and object types interactively via dialog boxes. To make this possible, *Mind's Eye* features a sexy, graphical user interface reminiscent of *Motif*. It includes an image editor for creating your own graphics, a text editor, easy-to-use query and reporting facilities, and an object-based data manager. Unlike *Windows*, this interface has real 3-D buttons and a consistent three-dimensional look and feel. The mouse-driven interface takes advantage of all three buttons on a three-button mouse, but will work with any mouse.

Unfortunately, some parts of the GUI are missing. There are scroll buttons for shifting a window's contents up and down a line at a time, but there's no scroll bar for quick moves and for positioning information. In addition, dialog boxes exhibit an odd, flashing behavior when you left-click their title bar. The fast, visually appealing workspace is in sharp contrast with the program's old-fashioned character-based text editor.

The company claims the editor is a modified public-domain editor, but for \$695 I'd expect a graphical text editor. Despite the program's nice GUI, *Windows* compatibility would make it more desirable. (The company says a *Windows* version is under way.)

The personal version of *Mind's Eye* has minimal

**FACT FILE**

Mind's Eye
Mind's Eye Inc., 18 Shangri La Dr., Lexington Park, MD 20653; 800-622-6746, 301-862-1944.
List Price: \$695; professional version, \$3,000.
Requires: 80286 processor or better, 640K RAM, graphics adapter, mouse, (2MB or more expanded memory and 3-button mouse recommended.)
In Short: A pricey, powerful, object-based data manager that lets you combine text, graphics, and data of any type in a flexible framework. Unfortunately, the program can be counterintuitive, and the documentation is confusing.

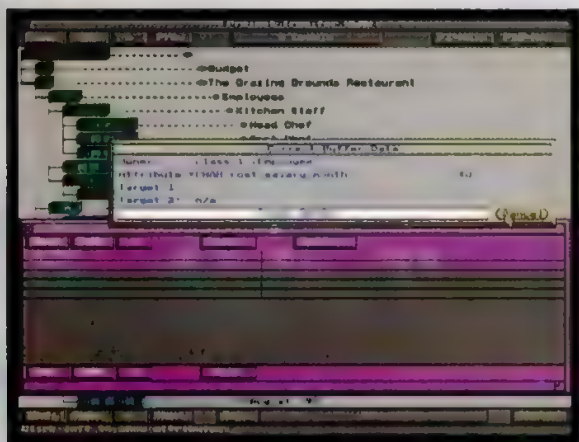
CIRCLE 702 ON READER SERVICE CARD

import/export facilities. You are also forced to take a convoluted approach to importing data from an existing DBMS, and are limited to 2,500 objects per project. A professional version, due shortly, will let you build projects with an unlimited number of objects, as well as offer royalty-free runtime facilities, network support, and the ability to specify your own text editor. But it'll cost \$3,000.

Theoretically, *Mind's Eye* is designed for sophisticated users. The company espouses it as a computer-aided management tool for use in situations where many views of complex, inter-related data are important.

But practically speaking, while the program is easy to use, it's not intuitive or easy to learn. Instead of using well-established terminology like tables, records, or fields, you are asked to digest a host of new concepts with no glossary, no step-by-step tutorial, only a minimal index, and a 26-page "Getting Started" guide that uses jargon to describe the decision-making process behind the single sample program. For \$695, database users and developers expect the tools and documentation found in *dBASE*, *FoxPro*, and *Paradox*.

Mind's Eye is unlike any software you've ever seen, but since it's the first of its kind, there's a pervasive unevenness. Watch for improved versions with better tools.



Mind's Eye combines principles of expert systems, hypertext, and object-oriented databases.



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First Looks

Frye's NEWS Automates Network Management

HANDS ON
by M. Keith Thompson
and Joe Rizzo

The \$495 *NetWare Early Warning System (NEWS)* from Frye Computer Systems does what computers do best: It monitors statistics and informs a human when certain parameters exceed designated limits.

NEWS monitors over 40 key *NetWare* statistics, compares them with an administrator's preset limits, and takes appropriate action based on user-defined criteria. For example, if an unattended file server runs out of disk space, *NEWS* can detect the shortage of disk space, back up some preselected files, delete them from the disk, and

notify you about the episode via electronic mail.

NEWS comes with excellent documentation; its installation could not be easier. Because its screens look and feel like the *NetWare* utilities, it's an easy program for *NetWare* administrators to master.

Selecting which data to monitor is done from a pick list of menu items. For each item, *NEWS* allows you to specify server and volume thresholds. Of the 40 options you can monitor, 20 can be modified to levels appropriate for your installation. (The only changeable volume option is the percentage of the disk space in use.) Common types of monitored server specifications include the percentage

of server utilization, connection usage, and disk utilization—all measured as a percentage of the maximum values.

You are also enabled to determine how frequently the computer checks these values. The default is 15 minutes, but you can specify intervals from 1 second to 99 hours. Finally, there's a feature that allows you to monitor the same statistics on multiple servers.

Once errors are detected the real fun begins. Various notification options include receiving an e-mail message on the network all the way to getting a call on your pocket pager. Some of Frye's extended notification requires optional software and hardware products described in the manual. For example, you can be notified via electronic mail, an alphanumeric pager, fax, or even a prerecorded voice message over the telephone. The voice option even allows you to call in and listen to the status of your servers.

Using the "response op-

tions" menu, you can back up certain files, delete others, or you can have your workstation run certain batch files in response to a problem.

The method used for entering lists of users for notification could be improved. Currently, instead of selecting them from a menu, in normal *NetWare* fashion, you must enter the names manually.

NEWS shifts the burden of routine LAN management tasks from the network administrator to the computer. The breadth of its monitoring functions and the numerous feedback mechanisms make sure you're informed of potential network catastrophes before it's too late. ■

List Price: *NetWare Early Warning System* 1.1, \$495; additional servers, \$250.

Requires: 512K RAM, floppy disk, Novell *NetWare* ELS, 2.1x or 386 3.1. Frye Computer Systems Inc., 19 Temple Pl., 4th floor, Boston, MA 02116; 617-247-2300.

CIRCLE 430 ON READER SERVICE CARD

A Trackball with Macro Power

HANDS ON
by Patrick Honan

The name sounds like a motorized exercise machine, but the \$199.95 *PowerTrack* is actually a programmable trackball/software combo that can significantly reduce the number of keystrokes you enter each day.

PowerTrack's hardware is a 1.5-by-6-by-4-inch (HWD) box that connects to the computer's serial port. A trackball is on the left side; a pad with 40 programmable keys is on the right. For those who prefer mice, ProHance offers *PowerMouse*, also with 40 programmable keys.

The programmable keys are much smaller than those on a standard keyboard, but your fingers quickly adapt to the close quarters. Lefties will be inconvenienced since they'll need to move the trackball with the pinkie or ring finger and select keys with the thicker middle and index fingers or the thumb.

The software comes with key definition tables (KDTs) that define the tasks for the pro-

grammable keys. *ProHance* includes KDTs for *Lotus 1-2-3*, *Microsoft Excel*, *Microsoft Windows*, *Microsoft Word*, *WordPerfect*, and other leading programs. These include definitions for many "common task" macros, such as averaging a range of numbers in 1-2-3 or spell-checking a document with your word processor. Optional KDTs are available for *AutoCAD* and *Ventura Publisher* (\$59.95 each).

You can create new KDTs and edit or delete existing ones using the included editor. Possible keystroke combinations appear in a grid that you can scroll through and select the combination you want to define. At the bottom of the screen is a 1-2-3-style command menu that includes functions such as saving KDTs and recording macros.

The editor runs as a stand-alone program or as a 70K TSR. It can create macros from within character-based applications by capturing keystrokes. The TSR will not work with graphics applications.



PowerTrack, a trackball with programmable buttons, is ideal for spreadsheet and CAD applications.

While the keystroke capture works with most text-based programs, I ran into problems trying to capture keystrokes in *Microsoft Works*. A *ProHance* technician told me this was because *Works* bypasses the BIOS when reading keystrokes. Hence, any program that bypasses the BIOS is not a *PowerTrack* candidate.

PowerTrack's benefits are most apparent with cursor-intensive applications. You can move the cursor with the trackball and activate the macro keys with a single hand. To move the cursor and activate macros with software-based macros, you must use two hands and either the keyboard alone, or keyboard and mouse. *PowerTrack* is also ideal for applications such as

spreadsheets and CAD programs that don't require many entries from the QWERTY section of the keyboard.

PowerTrack is much less valuable if you work with word processors and other applications that make heavy use of the QWERTY keys. In fact, having to shift your hands frequently between the keyboard and *PowerTrack* can actually slow you down, regardless of how many macros you use.

As useful as *PowerTrack* is, there are less costly software-based alternatives. ■

List Price: *PowerTrack*, \$199.95. **Requires:** Serial port. *ProHance Technologies Inc.*, 1307 S. Mary Ave., Sunnyvale, CA 94087; 408-746-0950.

CIRCLE 431 ON READER SERVICE CARD

PHOTOGRAPHY: THOM MCENAMON

A dramatic volcanic eruption scene. In the foreground, a person stands on a dark, rocky ledge, looking out over a vast, glowing orange and red lava flow. To the right, a large, dark, jagged rock formation is partially covered in bright orange lava. In the background, a massive volcano is erupting, with a large plume of dark smoke or ash rising into a dark, cloudy sky. The overall atmosphere is intense and fiery.

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LITTLE SPITFIRE SYSTEMS



INTRODUCING GATEWAY'S FI



HOT-PERFORMANCE 386 AND 486 SYSTEMS ARE IN ICY GRAY, CURVILINEAR MODELS

Although Gateway's 386 and 486 systems look entirely new, we limited changes on the inside to fine-tuning performance and reliability. In the Midwest, we firmly believe in the adage, "If it ain't broke, don't fix it." And these award-winning, price/performance systems definitely did not need fixing.

FASTER HARD DRIVES

Gateway's product development team is constantly searching the market for the highest performance, most reliable components. When we found a very reliable line of IDE (Integrated Drive Electronics) hard drives, the switch from ESDI drives was obvious. All models of the IDE drive include a built-in cache, making this one of the fastest drives on the market (as fast as 15ms access time, 10 Mb/second DTR).

TUNED MOTHERBOARDS

HOTTER VIDEO

Because our 386 and 486 computers already include the fastest, most reliable video card on the market, the only way we could improve video performance was to increase the size of video RAM. So we did. All Gateway 2000 386 and 486 systems come standard with 1 MB video RAM.

486 TECHNOLOGY AT 386 PRICES

When our 25 MHz 486 dropped below \$4,000, it was the hottest value going in high-end technology. Now Gateway's new 33 MHz 486 – fully loaded – is priced at \$3,995! You'd be hard pressed to find a loaded 386 for this price anywhere else. With either 486 system, you get Intel's 486 processor with built-in math co-processor and 8K cache.

EXPANDED SERVICE HOURS

We've also expanded our telephone technical support hours to provide

RE-AND-ICE POWER SYSTEMS

MORE FOR YOUR MONEY

With Gateway's new 386 and 486 computers, you get a terrific-looking machine. You get added performance and reliability. You get Gateway's excellent service and support with expanded hours. And you get it all for less money than ever before. That's the value. That's the Gateway 2000 difference.



1 8 0 0 5 0 5 5 5 2 3 2 0 0 0 0

INTRODUCING THE AWESOME ANY

In redesigning our new product line, we paid special attention to the things you use most: the keyboard and monitor. When you work with a personal computer for hours every day, you need a keyboard that feels good and makes your input tasks as easy as possible. And you need a monitor that's comfortable to look at. Our new AnyKey keyboard and Crystal Scan 1024NI monitor will give you exactly what you need.

THE PROGRAMMABLE ANYKEY

We call it the AnyKey because any key can be programmed to perform any function – anything you can imagine, quickly and easily. It's a revolutionary new concept designed to let you talk to your personal computer in a very personal way. Boilerplate information of all kinds can be easily assigned to any key and typed into any document with a single keystroke. Or you can remap the keys to create your own keyboard layout.

EXTRA KEYS. EXTRA VERSATILITY

The AnyKey includes a numeric pad and a separate, full-function cursor pad with diagonal keys, plus two sets of function keys located along the top and left side. Other features include an unshifted asterisk, two backslash keys, an adjustable repeat rate and a software tutorial.

EASY TO LEARN

The Anykey's versatility is rivaled only by its simplicity. You can learn to program it in just a few minutes. If you goof, you can easily reset the keyboard to a normal configuration. And if you hate the idea of programming anything, you'll still love the feel and extra keys on the AnyKey. Use it just the way it comes out of the box. The AnyKey keyboard is an option with all Gateway 2000 computer systems.



Peripherals, including the AnyKey and Crystal Scan 1024NI, are sold only with Gateway 2000 systems. Sorry – we cannot sell peripherals separately.

KEY™ & CRYSTAL SCAN 1024NI



NON-INTERLACED MONITORS – STANDARD WITH 386 & 486 SYSTEMS

From most manufacturers, a 1024 x 768 VGA color monitor is an expensive option. From Gateway 2000, 1024 x 768 color monitors have been standard for a long time. And now, the Crystal Scan 1024NI, a non-interlaced 1024 x 768 color monitor, is standard with all 386 and 486 systems.

Non-interlaced means all pixels are refreshed with each clock cycle – as opposed to interlaced monitors that take two clock cycles to refresh the entire screen image – for a solid, flicker-free video display.

LOOKING AHEAD

The introduction of our new product line represents almost a year of design and engineering. But it's just one phase in a process of continuous improvement that we employ at Gateway. Each day, Gateway 2000 employees come to work with one primary goal in mind: to provide you with better prices, performance, quality and service. We're committed to making Gateway 2000 the only logical choice in microcomputers.

We'd like to thank our customers for their valuable contributions to the redesign of our product line. It was our customers' suggestions and comments that gave us our direction. And to all the Gateway folks who began to think the 18-hour work day was normal, here's a public pat-on-the-back. Thanks for your continuing dedication.



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GATEWAY 2000 SYSTEMS

16MHZ 286 VGA

- Intel™ 80286 Processor
- 2 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 101 Key Keyboard
- MS DOS™ 3.3 or 4.01

\$1395

16MHZ 386SX VGA

- Intel 80386SX Processor
- 2 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 40 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 101 Key Keyboard
- Microsoft™ Mouse
- MS DOS 3.3 or 4.01
- MS Windows™ 3.0

\$1595

20MHZ 386SX CACHE

- Intel 80386SX Processor
- 32K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 512K
- 14" Crystal Scan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 1 PS/2 Mouse Port
- 101 Key Keyboard
- Microsoft Mouse
- MS DOS 3.3 or 4.01
- MS Windows 3.0

\$1995

25MHZ 386 VGA

- Intel 80386 Processor
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- Microsoft Mouse
- MS DOS 3.3 or 4.01
- MS Windows 3.0

\$2295

25MHZ 386 CACHE

- Intel 80386 Processor
- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 80 MB 17ms IDE Drive with 32K Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- Microsoft Mouse
- MS DOS 3.3 or 4.01
- MS Windows 3.0

\$2595

33MHZ 386 CACHE

- Intel 80386 Processor
- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- Microsoft Mouse
- MS DOS 3.3 or 4.01
- MS Windows 3.0

\$2995

25MHZ 486 CACHE

- Intel 80486 Processor with Co-Pro and 8K Internal Cache
- 64K Cache RAM
- 4 MB RAM
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 15ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- Microsoft Mouse
- MS DOS 3.3 or 4.01
- MS Windows 3.0

\$3495

33MHZ 486 CACHE

- Intel 80486 Processor with Co-Pro and 8K Internal Cache
- 64K Cache RAM
- 8 MB RAM, Expands to 64 MB
- 1.2 MB 5.25" Drive
- 1.44 MB 3.5" Drive
- 200 MB 17ms IDE Drive with 64K Multi-Segmented Cache
- 16-Bit VGA with 1 MB
- 14" Crystal Scan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 101 Key Keyboard
- Microsoft Mouse
- MS DOS 3.3 or 4.01
- MS Windows 3.0

\$3995



STANDARD SERVICES

- 30-day money-back guarantee
- One-year warranty on parts and labor
- Free bulletin board technical support
- Toll-free technical support for the life of the machine

- Free on-site service to most locations in the nation
- Replacement parts sent via overnight shipping free of charge
- Leasing options for commercial customers

We custom-build each Gateway 2000 computer to customer specifications. We'll gladly provide you with a quote on your configuration. Due to the volatility of the DRAM market, all prices are subject to change. Prices do not include shipping.

Sales hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CST)

Extended Service hours: 6am-Midnight Weekdays, 9am-2pm Saturdays (CST)



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First Looks

Smalltalk: The Granddaddy Of OOPS Meets Windows



The \$499.95 *Smalltalk/V Windows*, Digitalk's latest implementation of the Smalltalk programming language, joins an increasingly rich set of development tools for the *Windows* 3.0 environment. Its chief advantages are its consistent object orientation, its high level support for windowing environments, and its source-level compatibility with *Smalltalk/V PM*. Digitalk also sells a \$99 *Smalltalk/V DOS*, well suited for education and for personal developers.

The notion of programming using objects, which is a Johnny-come-lately idea for C and Pascal, largely originated with Smalltalk at Xerox Parc in the early 1970s. Unlike object-enhanced C or Pascal, where objects coexist with ordinary variables, everything in Smalltalk is an object. This consistency is one of the language's most important features, but the conventional escape hatches that exist in C or Pascal are unavailable in Smalltalk.

Smalltalk/V Windows consists of a single disk and a 600-page paperback book. The software installs easily and quickly, and even creates its own group in *Windows*' Program Manager. The book consists of 180 pages of introductory and tutorial material; the remainder is reference material. The tutorials help get you started, but most serious users will want to purchase one of the standard Smalltalk texts.

Smalltalk/V Windows is an interactive environment that contains a browser for examining Smalltalk objects, an integrated editor/compiler, and a debugger. Programming consists of extending the supplied objects to create an application. After making extensions and modifications, you "save the image," which makes a copy of the current environment. The

next time you execute the image, you start up exactly where you left off.

Smalltalk gains its power, in large part, from the windowing, graphics, and user interface classes supplied with the system. It takes just a couple of lines to write the ubiquitous "Hello World" program in *Smalltalk/V Windows*, in contrast to the pages it would take to write the same *Windows* program in C or Pascal.

But that's not to say that the *Smalltalk/V Windows* environment, taken as a whole, is a simple environment. There are about 175 classes and a total of about 2,500 separate class methods, plus the manual's 180-page long, small-typeface class encyclopedia.

Smalltalk/V Windows en-

courages an exploratory style of programming, which has been described as rapid prototyping that produces finished applications. You can even deliver applications with the exploratory features intact (contact Digitalk for licensing details), which enables technically adept users to extend and modify the product—a highly desirable feature in certain applications. Of course you can also deliver traditional frozen applications, which are not extensible or modifiable without incurring

separate licensing fees.

Smalltalk/V Windows is a robust and comprehensive object-oriented programming system for the *Windows* 3.0 environment—just the thing if you're looking for an object-oriented solution for *Windows* development problems. ■

List Price: *Smalltalk/V Windows* 1.0, \$499.95. **Requires:** 3MB RAM, hard disk, *Windows* 3.0. Digitalk Inc., 9841 Airport Blvd., Los Angeles, CA 90045; 213-645-1082.

CIRCLE 708 ON READER SERVICE CARD

askSam Adds Programming Oomph To Strong, but Cryptic App



Ask three different *askSam* users what the program does, and you'll get three different answers. One will tell you it's a fantastic textbase with a multitude of features for searching textual data. Another will say it's an arcane but powerful programming language for creating hypertext-like linked information systems. Still another may simply use a preprogrammed *askSam* application, not even realizing that *askSam* lies beneath it. Version 5.0 adds enhancements on all three levels, but the bulk of the changes are in the programming realm.

As a textbase, *askSam* can mix free-form data and fixed data fields. Explicit fields are defined using square brackets, for example, NAME[John Doe]. You can list the contents of such fields, sum them, and perform other database type operations on them. The command

John {IN} NAME[finds any record with John in the Name field. You can search just as easily on one or more words anywhere in the text, for example, John {AND} {NOT} Doe. Wild-card searches are accepted as well.

Report generation capabilities are on a par with advanced database products, but you'll have to learn the *askSam* language. For example, the command {VALUE JUSTIFY 40} NAME[{NAME JUSTIFY 55} \$::: outputs information in the Name and \$ fields.

The *askSam* textbase has hardly changed at all in the new version. The new Free Mode allows scrolling through records and free-form text much like any word processor. And Version 5.0 offers what it calls Relational Access: You can specify that any query you make in one *askSam* file should also act on other data files.

With the addition of subroutines and global variables, *ask-*

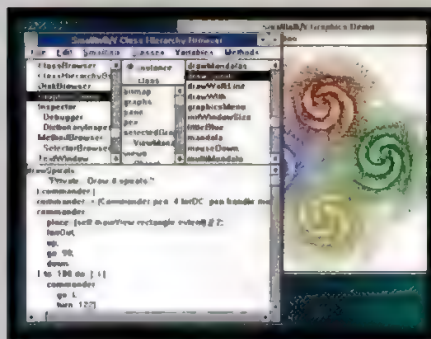
Sam takes on the characteristics of a high-level language. Dialog boxes now let the program query the user for input. Date and time generation allow for abbreviations, as well as U.S., European, and military conventions.

Unfortunately, the one area that has changed, but not for the better, is the manual. With its often counterintuitive commands and cryptic language, *askSam* is a tough product to master; a clear easy-to-understand manual is a necessity. While the previous version's poor manual has been updated, it hasn't improved.

The devoted body of *askSam* users will appreciate the new, more-powerful version. But this daunting program won't do much to attract newcomers. ■

List Price: *askSam*, Version 5.0, \$395; upgrade \$125. **Requires:** 384K RAM, DOS 2.0 or later, printer optional (640K and graphics adapter required for embedded graphics). askSam Systems, 119 S. Washington St., Perry, FL 32347; 800-800-1997, 904-584-6590.

CIRCLE 437 ON READER SERVICE CARD



Smalltalk/V's browser helps you learn. The left window examines a method; the actual program is shown on the right.

First Looks

MS's Productivity Pack: School for Windows



Microsoft expects to ship three million copies of its *Windows* operating system this year, and almost double that in 1992. Now Microsoft wants to be the teacher as well as the supplier for the *Windows* users-to-be.

The \$59.95 *Microsoft Productivity Pack for Windows* contains three *Windows* help products: *Learning Windows* (an interactive tutorial), *Working Smarter* (a compilation of hints and strategies), and *Quick Troubleshooter* (a Q&A 24-hour problem solver).

Learning Windows provides a walk-through of *Windows*' capabilities and is the strongest portion of the program. It's divided into six tutorial sections: *Getting Started*, *Windows Essentials*, *Working with Applications*, *Managing Your Files*, *Organizing Your Work*, and *A Day with Windows* (a 20-minute review session). Each of the 24 sections is subdivided into 5- to 10-minute lessons, totalling about 3 and a half hours. You can pick and choose select topics if you prefer.

For the most part, the lessons rely on a "tell-show-do" methodology. A topic is explained, then demonstrated with graphics and text, and then you get to try it yourself.

While the instructional methodology is top-notch, many topics are neglected, including *Windows* accessories like the Notepad, Cardfile, and Calendar; macros; and extended memory. The description of the dynamic data exchange facility is superficial.

Overall, the product is best suited to novice users or those who want a quick brush up on a rudimentary topic.

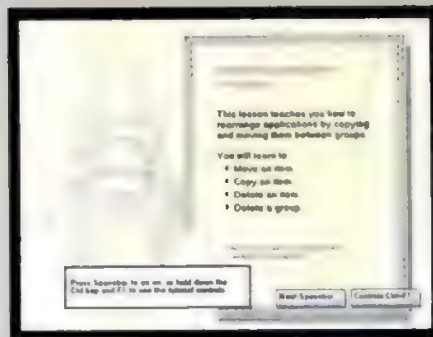
Part 2, *Working Smarter*, is a manual of tips for those things that are most likely to hang you up—things like connecting a network printer or changing a

program's icon. The manual's contents are divided into sections called *Speeding Up Your Work*, *A Personal Touch*, *Managing Information*, *Equipment Tips*, and *Printing Tips*. Although the tips are typically presented as a list of steps, the wording is often stilted, and there aren't enough examples.

The last product in *The Microsoft Productivity Pack* is the least praiseworthy. *Quick Troubleshooter* has sections on printers, networks, applications, and memory, but the solutions are often much too vague to be useful. Suggestions

provided such as "the problem is probably in your printer" are reminiscent of too many frustrating manuals.

Still, *Quick Troubleshooter* is an admirable attempt to offer a considerable amount of knowledge in a decision-tree structure. If you've ever called Microsoft's phone support, you



Designed to help you plot a *Windows* course, *Productivity Pak* combines tutorial and reference materials.

may find this a less frustrating alternative.

List Price: *The Microsoft Productivity Pack for Windows*, \$59.95. **Requires:** 640K RAM, DOS 3.1, *Windows* 3.0. Microsoft Corp., 1 Microsoft Way, Redmond, WA 98052; 800-426-9400.

CIRCLE 437 ON READER SERVICE CARD

Braincel's Neural Network for Excel



Every day thousands of hopeful souls stream into the local race-tracks, clutching rabbits' feet, copies of *The Racing Form*, hot tips from their barbers, and other tokens of faith. If the aspirations of Promised Land Technologies are realized, some of these people may carry laptops stuffed with *Microsoft Excel*, *Microsoft Windows*, and a copy of PLT's *Braincel*.

Braincel is a \$249 *Excel* add-in that offers neural-net technology. It's designed to solve forecasting problems not amenable to traditional forecasting techniques. Horse handicapping is only one of its more frivolous potential uses.

It comes with a tutorial for evaluating loan applicants, horse handicapping, and a full-blown "real world" case in which 43 economic variables from each of 25 years are processed to help real-estate developers predict the coming year. Other potential applications include any forecasting problem for which historical data exists and in which the relationship of input variables to outputs is difficult or impossible to quantify.

Braincel studies your historical data until it can produce satisfactorily reliable forecasts. Setting up a *Braincel* "expert" has four steps. First, set up your historical data in an *Excel* worksheet, with input and output in separate columns. Version 1.1 supports a total of 500 input and output variables. At the bottom of this grid, enter an expected minimum and maximum for each variable.

Second, you train *Braincel* on a subset of your historical data. Third, you test your fledgling expert on a subset of the training inputs. If *Braincel* gets enough of the outputs right, you proceed to step 4; otherwise, you retrain and retest. Finally, test *Braincel* on the portion of historical data that you withheld during the training step. If it gets these outputs right (or right enough), your expert is ready.

In its normal operating mode, *Braincel* uses the back propagation algorithm, adjusts the learning rate during training, sets processing parameters to general-purpose defaults, and does a passable job of hiding neural-net terminology from the user. The brave and knowledgeable may choose a Professional User mode, which permits man-

ual adjustment of learning rate, momentum, number of hidden layers and hidden nodes, connection weights, and other factors. Advanced users will also appreciate the ability to select an alternative algorithm (back percolation) and to record an expert's training history.

While you can certainly operate *Braincel* without understanding the technical details, you will need *Excel* proficiency and a good deal of common sense. In particular, you'll need to understand what kind of problems are suitable, how much training is appropriate (too much can cause *Braincel* to memorize your data), and what level of trust to confer on the program's output.

Compared with standalone neural-network software, *Braincel*'s *Excel* connection is a huge convenience because you get access to the spreadsheet's function library and charting facilities. It also allows *Braincel* to be macro-driven and hot-linked to data sources.

List Price: *Braincel* 1.1, \$249. **Requires:** 2MB RAM, *Excel* 3.0; coprocessor recommended. Promised Land Technologies Inc., 900 Chapel St., #300, New Haven, CT 06510; 203-562-7335.

CIRCLE 701 ON READER SERVICE CARD

Quick, name the world's best memory manager:

NETROOM!

Right!



Jan. 29, 1991

If you thought the answer is QEMM® or 386MAX®, think again. Because **NETROOM**® just beat them both, by winning PC Magazine's prestigious Editors' Choice award.

PC Magazine said: "With its versatility, this \$149 four-user version rates as a real winner. Considering **NETROOM**'s price and capabilities, you will find that there is no second choice."

What makes **NETROOM** a winner is that it is more than a great LAN manager. It is a full-featured memory manager that not only relocates LANs (like Novell, VINES®, etc.), it also moves device drivers, and TSRs into extended, expanded, and high-DOS memory.

Features:	NET-ROOM	QEMM	386 MAX
Windows 3.0 support	✓	✓	✓
Multuser license	✓		
Converts Ext. to Exp. †	✓	✓	✓
Relocates to High-DOS	✓	✓	✓
Relocates to LIM 3.2 Frame	✓		
Relocates to Expanded	✓		
Relocates to Extended	✓		
Works on 386/486	✓	✓	✓
Works on 8088/286	✓		
Memory Analysis Utility	✓		

And, **NETROOM** is the only memory manager that runs on all PCs (8088 through 80486).

But, there's more...PC Magazine says it's "The most flexible product we tested,"...and... "**NETROOM** uses a unique swapping feature to access data and programs in extended or expanded memory...Even PCs with tightly jammed high-DOS areas can benefit from the memory swapping capabilities of **NETROOM**."

And to top it all off, with **NETROOM** you will get absolutely **FREE-DISCOVER**®, an excellent utility that makes installation a pleasure and provides a detailed, real-time view of the memory configuration and

possibilities within a PC.

PC Magazine says "Netroom's \$149 price for four users is a steal." So, go out and steal yourself a copy!

Available from Helix or at your local dealer.

Requirements: A 386, or some EMS 3.2 or EMS 4.0 memory hardware, or at least 64K ext. memory and DOS 3.3 or greater

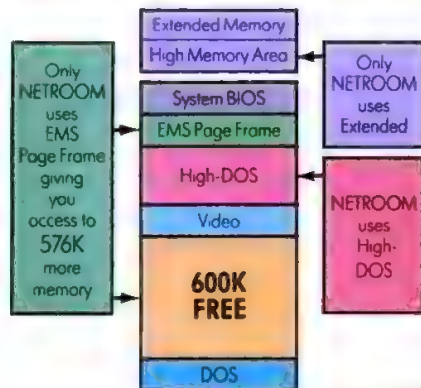
†This feature not available on 286 machines

1-800-451-0551

*Single User, 4 User \$149, 10 User \$249 plus \$5 per order shipping & handling

HELIX SOFTWARE COMPANY

47-09 30th St., Long Island City, NY 11101 (718) 392-3100



Available at **EGGHEAD SOFTWARE** —call 1-800-Egghead, and at fine dealers everywhere

CIRCLE 313 ON READER SERVICE CARD

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Sir Lawrence pulled Volume IV from the shelf, blew off a cloak of dust and opened the brittle pages. He could scarcely believe what he found inside.

True, he hadn't consulted these particular journals in years and, admittedly, he had acquired the ten-volume set in his youth from an odd little book store on the

Thames, but still! Holes!? A bookworm had eaten clean through the pages. Indeed, to Sir Lawrence's considerable chagrin, he found the ravenous little bugger had chewed, in a straight line, from the front cover of Volume I to the back cover of Volume X.

All of which brings us to our seemingly simple question: If each book is exactly two inches thick, how far did the bookworm travel?



In tussling with this type of cerebral aerobics, most people make a simple but serious error: They *assume* something. Of course, this happens without realizing it. But still, it happens.

As you'll see in a moment, the way to avoid making a false assumption is to work things out methodically. Carefully thinking through each step.

For instance, consider this question. A company makes one of the broadest lines of computer terminals in the world. They have for years. In fact, they've delivered over three million of them.

If you needed terminals you'd probably think of them. But what if you needed PCs? Would you assume that, since this company is so dominant in terminals, they must not do a real number in PCs? learned nothing?

Tsk, tsk. Have you Well, as you may company in question is Wyse. we don't have an impressive PCs it would be a shame.



And if you've been assuming array of powerful, priced-right For both of us.

Consider our models that offer a rich power supplies, three styles of ergonomically advanced chassis, multiple configurations, popular Wyse-designed keyboards, aggressive pricing and bundled DOS 4.01. For starters.

The Decision Series PCs: 386sx/16s (shown), 386sx/20, 486/25, 486/33e (shown). Advanced ergonomics, finicky attention to detail, exceptional power for the dollar.

new Decision Series. Four set of features. Generous

Of course we realize there's a good chance some of you may have read this far because you're more interested in the answer to our puzzle than in our products. You've *assumed* we'd bury the answer down here somewhere. Well, you're wrong again. At least partially. So go look on page 459.

Now that it's clear we make an impressive line of PCs, you might be tempted to assume we stop there and don't get into the even more sophisticated products like super fast multi-processing systems for the UNIX environment. With speed in the 100 MIPS range.

But you wouldn't assume that after all this. Would you?

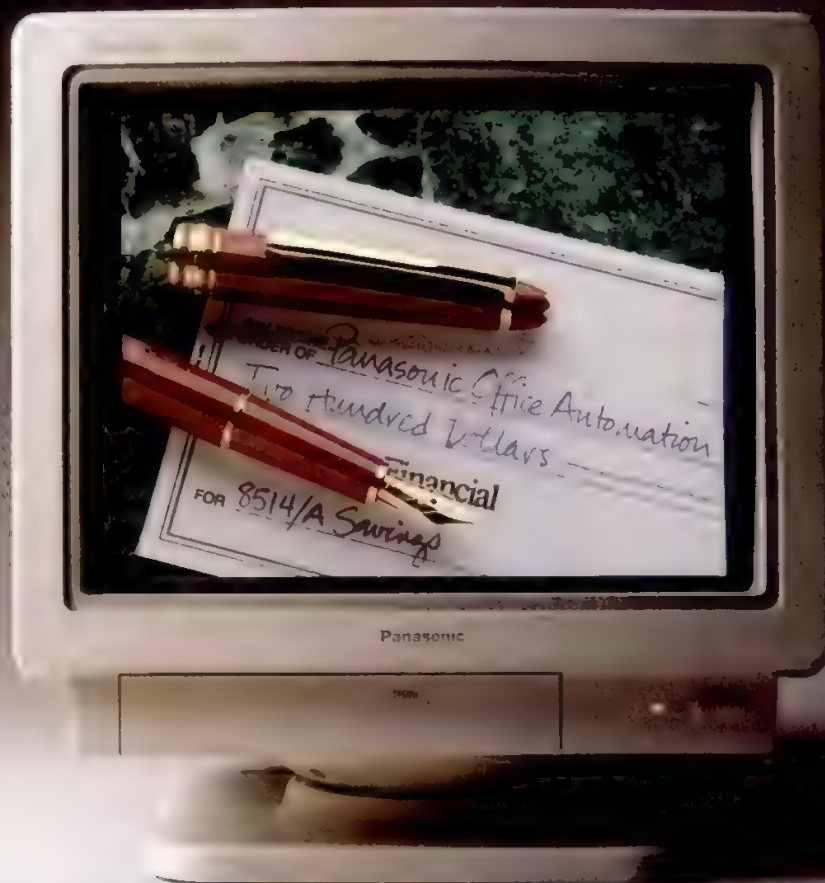
To learn more about our Decision Series PCs call us. We'll send you complete specs plus a poster of additional Cerebral Aerobics. To help keep your original equipment personal computer in top form. 1-800-GET WYSE.

WYSE

You're doing it again. Just because this little type is down here and printed upside down you assumed you'd find the answer this early. No way. San Jose. Refer back up to the ad and your patience will be rewarded.

Introducing the PanaSync™ C1381 Monitor.

8514/A resolution. VGA® price.



If you want the ultimate VGA graphics standard, and you've resigned yourself to paying a premium of hundreds of dollars to get it, you'll find our newest monitor pleasant viewing indeed.

The PanaSync C1381 gives you a sharp 1024 x 768 pixels, with 0.28 dot pitch. And virtually infinite color resolution. It's compatible with the most popular VGA boards, as well as analog RGB, MCGA, SuperVGA, and — of course — 8514/A standards.*

It's comfortable in virtually any IBM-compatible or Mac II environment.**

And it's a masterpiece of ergonomics. With front-mounted controls, tilt/swivel stand, plus a non-glare tinted black-matrix screen.

All this at a suggested retail price comparable to many of the ordinary VGA monitors on the market right now. For more information, simply call toll-free 1-800-742-8086.

*Peripherals, Computers, Printers,
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Panasonic
Office Automation 

PanaPro™ Monochrome Desktop Publishing Monitors with Video Adapters.



(Mac SE)

(Mac II)

(IBM XT/AT & PS/2 Model 30) CIRCLE 746 ON READER SERVICE CARD

PanaSync™ Multiscanning Color Monitors.



* VGA, MCGA and 8514/A are trademarks of International Business Machines Corp.

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by
Cristina Córdova
and Nate Zelnick

New & Improved

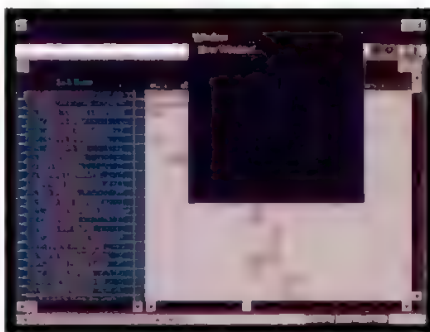
News of Announced Products and Upgrades

Symantec Launches a Project Planning Tool For Windows Users

NEW Symantec Corp.'s \$399 *On Target* provides project planning software for Windows 3.0. Geared toward managers and not professional project planners, the package supports scheduling and coordination of multiple projects and allows managers in a workgroup environment to share project schedules across LANs. The graphical WYSIWYG display simplifies project preparation and report generation.

Drawing on familiar formats such as spreadsheets, outlines, calendars, and bar charts, *On Target* provides basic project planning functionality. A Schedule Assistant guides you through the planning process and automatically generates the underlying schedule logic. A Project Calendar presents schedule information in a familiar calendar-style format. You can also graphically display actual versus planned project information in order to reconcile future planning.

On Target lets you quickly transfer data between reports and presentations. The fea-



On Target's graphical display of project plans compares your intended schedule with your actual performance.

tures offer many font, color, and graph options. You can output project plans and reports in black and white, or to color PostScript printers. You can also import and export data from other Windows applications and non-Windows applications like Lotus 1-2-3.

List Price: *On Target*, \$399. **Requires:** Windows 3.0. Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014-2132; 408-253-9600.

CIRCLE 440 ON READER SERVICE CARD

HOT PROSPECT

FIFTH GENERATION SYSTEMS' DISKLOCK PROTECTS DATA WITH SIMPLE FILE HIDING OR FULL DES ENCRYPTION

Fifth Generation Systems, publishers of *FastBack*, *Direct Access*, and *The Mace Utilities*, have introduced *DiskLock*, a password protection system that can prevent access to individual files, subdirectories, or entire disks. *DiskLock* provides several levels of security, beginning with simple hiding of files (by changing DOS file-attribute bits) and extending up to DES-level encryption of all files on a disk, including the partition table.

The \$189 package offers two levels of control over access to a disk. A primary user maintains total control over the disk security, and a secondary user can access only those files that the primary user designates. An administrative password feature can also be used to gain access to a disk.

DiskLock also includes a screen blanker, a quick-encryption scheme, and an audit feature that records unsuccessful attempts to gain entry to the system.

List Price: *DiskLock*, \$189. **Requires:** Hard disk, DOS 2.1 or later. Fifth Generation Systems, 10049 N. Reiger Rd., Baton Rouge, LA 70809; 800-873-4384, 504-291-7221.

CIRCLE 430 ON READER SERVICE CARD



DiskLock performs DES encryptions of single files or entire directories.

Group Productivity for Multiple PC Platforms

NEW Designed for use with multiple PC platforms, ISoft's new group productivity software, *ITeam*, helps workgroups plan, coordinate, and track their work flow. Included in the *ITeam* package are three versions of the program—DOS, Windows, and OS/2 Presentation Manager, each supporting multiple users via LANs. Workgroups can run any mix of workstations using these platforms; all three versions share a common user interface and file formats.

ITeam allows you to assign tasks, prioritize work, and check task status. You can also post meeting notices and messages.

In addition, *ITeam* depicts the group's daily workload in amounts, percentages, and graphics. A status query option allows supervisors to check on the progress of a task at any given time. And a text/graphics notebook functions as a personal database with autosorting, auto-dial, and a built-in word processor.

List Price: *ITeam*, for two users, \$295; for each additional user, \$99. **Requires:** DOS 3.0 or later, OS/2 1.2 or later, or Windows 2.x or later. ISoft Corp., P.O. Box 1320, Middletown, CA 95461; 800-326-4391, 707-987-0256.

CIRCLE 441 ON READER SERVICE CARD

WindowView Lets You Share Files Across Unix and DOS LANs

NEW You can now access multiple applications across various LANs and systems. Atlantix's new \$195 software package, *WindowView*, features a virtual terminal emulation facility based on Windows.

When operated in conjunction with Atlantix Access or *CocoNet*, *WindowView* permits DOS users to access multiple Unix and DOS sessions simultaneously. It also allows you to transfer information between multiple DOS and Unix workstations.

The software provides full ANSI console support, including function keys and graphics characters.

List Price: *WindowView*, \$195. **Requires:** Windows 3.0. Atlantix Corp., 4800 N. Federal Hwy., #301-B, Boca Raton, FL 33431; 800-262-6526, 407-362-9700.

CIRCLE 442 ON READER SERVICE CARD

BRIEFS



PRINTERS

Epson's LQ-200 dot matrix printer provides 80-column, 24-pin printing with seven built-in fonts and a choice of three paper-loading paths. According to Epson, the \$399 unit prints at speeds up to 192 characters per second at 60 to 360 by 180 dot-per-inch resolutions. 213-782-5161.

NEC's new color thermal transfer PostScript printer—the \$6,995 Color-mate PS Model 40—features 4MB of RAM and 17 Adobe typefaces. 508-264-8000.

NCR claims that its new 6481 laser printer systems deliver speeds of 88 pages per minute. The \$172,900 printers use Advanced Function Printing software, and Advanced Function Printing Data Stream; this enables combinations of alphanumeric characters, OCR characters, numerous fonts, symbols, logos, and graphics on a single page. The printers come with 8MB of memory and 240-dot-per-inch resolutions. 513-445-5278.

Packard Bell has introduced two HP-compatible laser printers with claimed speeds of 8 pages per minute. The \$1,795 PB9805 printer comes with 512MB of RAM, while the \$1,995 PB9815 comes with 1.5MB (expandable to 4.5MB). Each offers 300-dpi resolution, eight built-in fonts, and one optional font slot. 818-773-4400.

Extended Systems' new ShareSpool 2184—an eight-user, internal printer-sharing device—automatically configures the HP LaserJet III Si printer for PostScript or PCL printer language. The \$995 hardware-only solution plugs into the modular I/O slot of the printer. ExtendedLink Technology allows PCs to be as far as 500 feet from the printer. 208-332-7575.

Rose Electronics has designed a device that connects your HP LaserJet directly to your Ethernet LAN—\$549 for thin Ethernet support and \$649 for twisted-pair Ethernet. The LanJet card plugs directly into your printer's I/O expansion slot, and comes with an additional RS-232 serial port for connections to PCs, plotters, printers, or modems. 713-933-7673.

LAN Inventory System Tracks PC Components

NEW. Designed to give network managers complete control over their LAN assets, **Brightwork's LAN Automatic Inventory (LAI)** automatically builds and maintains a database of LAN software and hardware components. It periodically audits that database for all changes and discrepancies, and detects any swapped hardware.

LAI scans entire networks for workstation and file server information, including network addresses, and file server hard disk types and sizes. At log-on time, it checks every PC's components—type and brand of CPU, math coprocessor, bus type, clock speed, hard and floppy disks, keyboard type, and base, extended, and expanded memory. Managers can sort these components by category and store any additional information into the equipment record.

LAI operates on Novell *NetWare* via IPX. It comes with Novell's multiuser *Btrieve* 5.1. **List Price:** *LAN Automatic Inventory*, \$695 per file server. **Requires:** 640K RAM, 2MB network or local hard disk space, DOS 3.1 or later, Novell *NetWare*. Brightwork Development Inc., Kerral Center West, 766 Shrewsbury Ave., Tinton Falls, NJ 07724; 800-552-9876.

CIRCLE 448 ON READER SERVICE CARD

Hard and Soft Fonts for HP-Compatible Printers

NEW. Two companies—**Good Software Corp.** and **Elesys**—have announced new products that offer additional fonts for HP and HP-compatible printers.

Good Software's 25 in 1 SoftCartridge is a low-cost, software-based equivalent to Hewlett-Packard's font cartridges—A to Z. The \$129 software package is fully compatible with all HP and HP-compatible printers and includes a Soft Cartridge Manager that simplifies soft-font selection and downloading. You can also download the software to your printer before you start your application software, so your applications won't need to download soft fonts. The *25 in 1 SoftCartridge* is compatible with *WordPerfect*, *WordStar*, *Ventura Publisher*, and *Aldus's PageMaker*.

Elesys' Elefont Desk/Headline Euro Cartridges provide a full Roman-8 character set with all the characters for printing any Western European language. The \$299 package contains a set of two cartridges with a total of 56 fonts in both CG Times and CG Triumvirate typefaces. Text sizes range from 5 to 30 points. Compatible with all HP DeskJet 500 and DeskJet Plus printers, the Euro Cartridges come with free printer drivers that are compatible with most major word processors and *Microsoft Windows 3.0*.

List Price: *25 in 1 SoftCartridge*, \$129. **Good Software Corp.**, 13601 Preston Rd., Dallas, TX 75240; 214-239-6085.

CIRCLE 444 ON READER SERVICE CARD

List Price: *Elefont Desk/Headline Euro Cartridges*, \$299. **Elesys Inc.**, 528 Weddell Dr., Sunnyvale, CA 94089; 408-747-0233.

CIRCLE 445 ON READER SERVICE CARD

Low-end Network OS Works with NetWare

NEW. **Everex Systems** and **WebCorp** have joined forces to introduce *Everex-Web*, a network operating system that allows users to share all network resources. In addition, users can optimize any station on the network for use as a server for multiple applications or databases.

Everex-Web offers low RAM overhead, an easy migration path to *NetWare*, and hardware independence by linking any *NetWare* shell driver that meets IPX specifications. It also includes electronic mail, network spooling, and an application for managing access to local file and device resources. You can load these services into high memory as a TSR in order to provide access from within other applications.

For \$249, Everex is offering a single-user copy of *Everex-Web* bundled with the company's 8-bit Everex SpeedLink network adapter. The software can also be purchased separately in 5-, 15-, and 30-user versions.

List Price: *Everex-Web*, 5-user version, \$495; 15-user version, \$995; 30-user version, \$1,495. **WebCorp**, 3000 Bridgeway, Sausalito, CA 94965; 415-331-0911. **Everex Systems Inc.**, 800-821-0806.

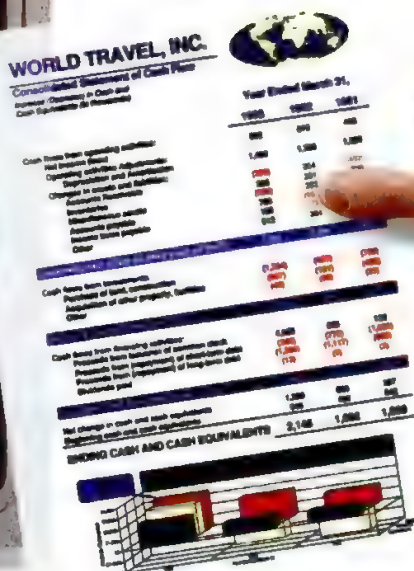
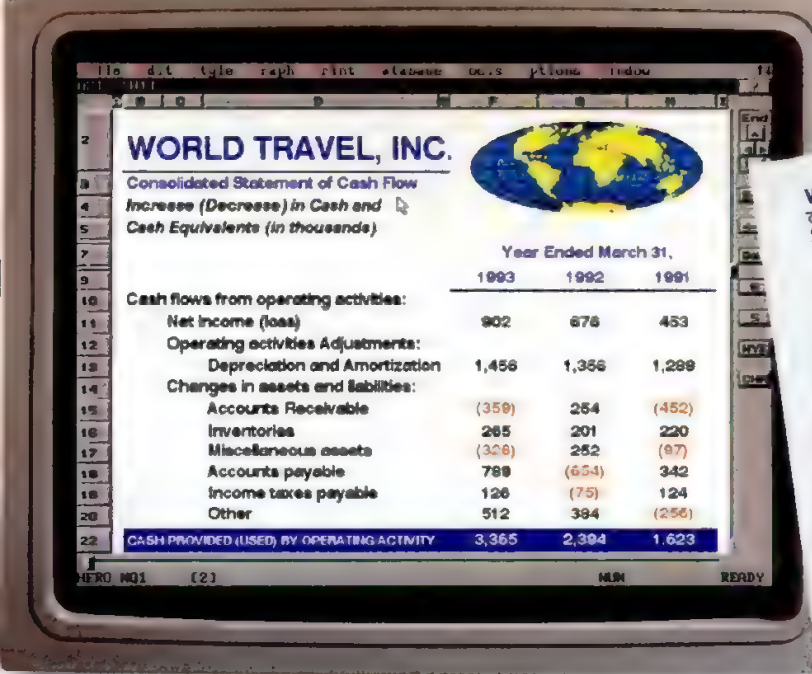
CIRCLE 446 ON READER SERVICE CARD

Security System Uses Identification Cards

NEW. A credit card-like device from **Data-media Corp.** protects workstations and networks against viruses, data theft, and unauthorized access. The Personal SECUREcard holds personal authentication and workstation configuration information. When users insert their SECUREcard into a workstation, the Card Reader configures and activates the system. Supervisors can restrict a single user to a specific workstation or a large group of users to multiple workstations.

The network security system includes a runtime security subsystem that allows the Personal SECUREcard to identify and authenticate the users, and configure their systems before loading DOS or any application software. An intermission lockout feature provides a way of suspending operation simply by removing the card. For further protection, a hardware feature detects and thwarts attempts to override the security restrictions.

CONTINUES ON PAGE 58



With Quattro Pro's WYSIWYG, what you see onscreen is what you get on paper.

Borland's New Quattro Pro 3.0 WYSIWYG and WYSIWOW!

Quattro® Pro is the hottest spreadsheet on the market. Consistently delivering the best power features: Multiple worksheet consolidation, advanced publishing and 1-2-3® compatibility.



Now Quattro® Pro 3.0 adds WYSIWYG, plus

Choose from a spectacular library of fonts, colors, graphics and clip art to create winning presentations. There's even slide-show sound and transition effects!

Quattro Pro 3.0 beats 1-2-3. Again.

Feature	Quattro Pro	1-2-3 r3.1	1-2-3 r2.2
"Live" editable WYSIWYG spreadsheet	Yes	Yes	No
WYSIWYG page preview	Yes	No	No
Banner (sideways-oriented) printing	Yes	No	No
Print-To-Fit* automatically on a page	Yes	Yes	No
Backsolver technology built in	Yes	No	No
3-D graphs (ribbon, step, bar, area, pie)	Yes	No	No
Worksheet zoom	Yes	Yes	No
Draw package built in	Yes	Yes	No
Clip art library	Yes	No	No

a theatre full of graphics, publishing and presentation features that will dazzle even the most demanding audience. And, unlike 1-2-3, all of Quattro Pro's features, including WYSIWYG, are seamlessly integrated into one set of menus, greatly enhancing ease-of-use. Just another example of how Quattro Pro's advanced technology is built in... not tacked on.

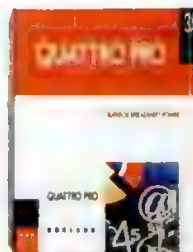
1-2-3 Users!

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Join the more than 3/4 million people who have already switched! And for an additional \$49⁹⁵, you can get ProView,* the ultimate presentation toolkit. Includes 60-day, money-back guarantee. Order today! See your dealer or call now 1-800-331-0877.



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BORLAND

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*ProView includes 100 additional CGM clip art images, 20 professionally designed chart styles, a full color "how to" presentation guide, additional fonts and sounds, plus \$100 worth of 35mm slide service processing. Upgrade pricing in U.S. dollars and good in U.S. and Canada only. Dealer prices may vary. Copyright ©1991 Borland, Inc. 1401

CIRCLE 287 ON READER SERVICE CARD

BRIEFS

**LAN WORKSTATIONS**

Everex is shipping the STEPserver 486/33E, a 12-slot 486-33 EISA file server. An EISA SCSI host adapter enables storage capacities over 4GB internally or 10GB externally. The system, priced from \$9,000 to \$14,000, comes in a cube chassis and is fully upgradable. 800-821-0806, 415-498-1111.

Hyundai Electronics has introduced the 12-MHz Super-286E Plus. This \$995 small footprint system features 1MB of RAM (expandable to 4MB), and support for EMS expanded memory. It comes standard with a 1.2MB 5.25-inch floppy disk, but a 40MB hard disk is optional. 408-473-9200.

**ETHERNET**

NetWorth has designed an intelligent 10BASE-T module.

The \$2,995 Series 4000 EtherNext Smart 10BASE-T Module combines unshielded twisted-pair connectivity with network management capabilities. When installed in an EtherNext Series 4000 Concentrator, the Smart Module manages all other 10BASE-T modules installed in the same Concentrator. 800-544-5255, 214-869-1331.

Thomas Conrad's "three-in-one" Ethernet adapter, the TC5045-TIO, is a 16-bit adapter that includes RJ-45, BNC, and AUI connectors. The \$499 adapter uses four LEDs to indicate link integrity, transmit, receive, and collision detection signals. 800-332-8683, 512-836-1935.

**MASS STORAGE**

Alloy Computer Products

has introduced a new line of tape backup products for PCs and LANs. The three Retriever/120 units include external and internal models. They each provide 120MB of data storage on one DC120 cartridge tape. 800-544-7551, 508-481-8500.

Irwin Magnetic Systems is shipping a new line of quarter-inch data cartridge backup systems. The 7000 series features a backup capacity of up to 500MB, advanced data compression, and LAN support. All models come with EzTape software, and prices range from \$1,595 to \$1,995. 313-930-9000.

CONTINUED FROM PAGE 56

The security system uses a 16K address space in high system memory. The system requires one full-sized ISA or EISA expansion slot and one internal storage drive bay. Datamedia Corp. offers a Personal SECUREcard reader system for \$495 and an administration software system for only \$500.

List Price: Personal SECUREcard reader system, \$495; administration software system, \$500. **Requires:** 16K available memory and MS-DOS 3.3 or later. Datamedia Corp., 20 Trafalgar Sq., Nashua, NH 03063; 603-886-1570.

CIRCLE 447 ON READER SERVICE CARD

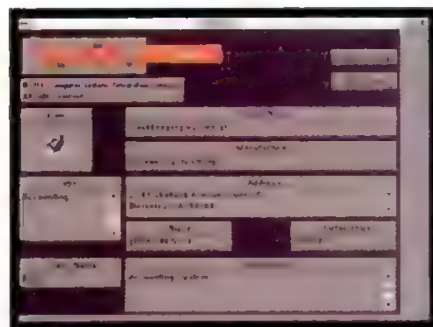
Windows 3.0 Front End Designed for Networks

NEW Computer Systems Integration Services has designed *WinMan*, a networkable front end for *Windows*. Taking advantage of *Windows* 3.0's graphics capabilities, *WinMan* provides a colorful, icon-based menuing system that lets you install up to 64 applications and utilities into application menus, and up to eight application menus in group menus.

Network supervisors can manage centralized initialization files. A log-on feature obtains names and initials that can be used to identify users to the network. A transaction tracking feature logs the customer name, application, user name, and time of use—so that customer billing based on usage is possible.

WinMan is fully user customizable; you can save multiple customized copies of it under a single network directory. Customizable initialization files include location of applications, user directories, and options.

A network-independent design allows the same



WinMan's WinBook feature keeps files of information about your *Windows* apps.

version of *WinMan* to run *Novell*, *3Com*, *LAN Manager*, and *Banyan's VINES*.

List Price: *WinMan*, \$49 plus shipping and handling for a single-user license; \$10 for each additional workstation. **Requires:** *Windows* 3.0. Computer Systems Integration Services, 945 N. Medalist, Plano, TX 75023; 214-517-3637.

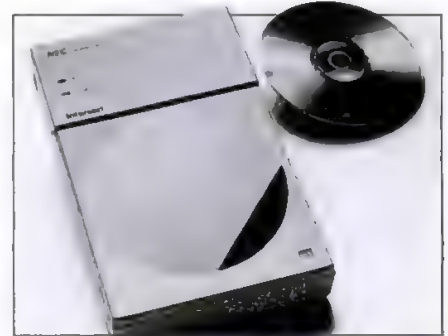
CIRCLE 443 ON READER SERVICE CARD

NEC's New Portable CD-ROM Reader Weighs 2.2 Pounds

NEW NEC's new Intersect CDR-36 portable reader, a \$599 SCSI device, weighs 2.2 pounds and supports multiple PC platforms.

A \$149 Parallel-to-SCSI host adapter links the Intersect CD-ROM to most desktops, laptops, or notebook PCs. NEC also offers a package containing both the CDR-36 and the Parallel-to-SCSI interface kit for \$698.

In addition, NEC is bundling the Intersect CDR-36 with SCSI interface kits that connect with PC platforms such as XT/AT (\$798), PS/2, (\$898), and Macintosh (\$698). Users can purchase an optional battery pack for \$99.



NEC's Intersect CDR-36 portable reader comes in a sleek one-piece design.

List Price: Intersect CDR-36, \$599. NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191; 708-860-9500.

CIRCLE 449 ON READER SERVICE CARD

CD-Net Software Lets Users Share CD Data Across Multiple Drives

NEW Meridian Data has created a software-only solution for networking CD-ROMs. *CD Net Software* operates on *Novell NetWare* and *NetBIOS*-based network applications.

The \$499.95 (2-user version) package allows you to integrate multiple CD-ROM drives into a standard LAN. Its data-caching capabilities increase the access speed of network drives. Multitasking capabilities permit simultaneous access on multiple CD-ROM drives.

CD Net Software includes CD-ROM menuing software tools that enable users to customize their menus.

List Price: *CD Net Software*, \$499.95 for 2-user version; additional 10-user version, \$250; additional 100-user version, \$999.95. **Requires:** *Novell NetWare* or *NetBIOS*. Meridian Data Inc., 5615 Scotts Valley Dr., Scotts Valley, CA 95066; 408-438-3100.

CIRCLE 450 ON READER SERVICE CARD



Make Powerful Connections with Borland's Paradox

By any standard, Paradox® is the most powerful database. That's why it's been rated #1 by every leading

computer publication, and why hundreds of thousands of users worldwide have switched to Paradox.

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With Paradox® SQL Link (sold separately),* Paradox makes it easy to connect PCs to the networks and SQL servers of your choice.** No programming is required. Users don't need to learn SQL. And since LAN traffic is kept to a minimum, answers to queries are delivered FAST!

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Paradox 3.5 incorporates VROOMM™ and Turbo Drive™. These proprietary Borland technologies let Paradox

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CODE: ME68

*Paradox SQL Link (\$495 U.S. suggested retail) is an add-on product for Paradox 3.5 and is required to make the connection with SQL servers. **Microsoft, IBM, SYBASE, Oracle and DEC Rdb/VMS servers supported now. †Offer also good for owners of any version of RBASE or dBase. Proof of ownership (a page from the manual) is required. Satisfaction guaranteed or your money back. Upgrade offer expires July 31, 1991. Upgrade pricing good in U.S. and Canada only. Max. orders to Borland International, Inc., P.O. Box 660001, Scotts Valley, CA 95067-0001. Add \$9.00 for shipping and handling. Residents in CA, CT, GA, IL, MA, MI, MN, NJ, NY, OH, PA, TX, VA and WA, please add appropriate sales tax. MI, PA, and TX residents please add tax to freight charges. For orders outside the U.S., call (408) 438-5300. All prices are in United States dollars. Copyright © 1991 Borland. All rights reserved. BI 13858

CIRCLE 285 ON READER SERVICE CARD

Improved

BRIEFS



SPREADSHEETS

Symantec Corp. has released *SQZ 2.0* (\$99; upgrades \$39), its add-in for *Lotus 1-2-3* and *Symphony*. The new release offers up to 95 percent file compression for all *Lotus* worksheets and adds support for 1-2-3, Release 3.1. 408-253-9600.

Brubaker Software has added *Symphony* support to the *Worksheet Optimizer* (\$99.95). The program can reduce worksheet size 25 percent by removing unnecessary information and optimizing formulas. 317-497-2928.



DATABASES

Addison-Wesley now offers a student edition of *dBASE IV*, 1.1 (\$50). The tutorial version, which has most of *dBASE IV*'s features, is limited to 120 records but contains an introduction to RDMS and SQL programming. 800-343-8080, 617-944-3700.

ESP Computer Systems has improved the data compression rates of *Advanced DB Master* (\$695). The program can now reduce database files up to 75 percent. 800-245-6934.

Environmental Systems Research Institute now offers links to *dBASE III* and *IV* files for its geographical information system, *PC ARC/INFO*. The basic five-module bundle costs \$4,995; the starter kit costs \$1,495. 714-793-2853.



DOCUMENT PROCESSING

Reference Software's *Grammatik Windows* (\$99, upgrades, \$29 or \$39 for *Grammatik IV* users) now works within Microsoft's *Word for Windows* and *Lotus' Ami Pro*. Also new in Version 2.0 are more comprehensive error-checking, links to other spell-checkers, and new editing commands. 800-872-9933, 415-541-0222.

Bitstream introduces *FaceLift* for *WordPerfect 1.5* (\$99; upgrades \$29.95), which adds on-the-fly scalable font support for dot matrix and ink jet printers as well as three new symbol fonts. 617-497-8222.

Cyrix Releases 40-MHz DX, 25-MHz SX Math Coprocessors

IMPROVED

With the release of its *Fas-Math 83D87-40* and *83S87-25*, **Cyrix** now offers math coprocessors for all 386 chip speeds. The chips are pin-compatible with Intel's 80387 and offer up to 5.5 MFLOPS (millions of floating-point operations per second) in applications that take advantage of floating-point operations. The coprocessors are optimized for systems using the *AM386-40DX* and *AM386-25SX* CPUs from Advanced Micro Devices. **List Price:** *Cyrix 83D87-40*, \$1,075; *Cyrix 83S87-25*, \$599. **Requires:** PCs using *AM386-40DX* or *AM386-25SX* CPUs. **Cyrix Corp.**, 1850 N. Greenville #184, Richardson, TX 75081; 214-234-8387.

CIRCLE 433 ON READER SERVICE CARD

Expanded CorelDRAW Distributed on CD

IMPROVED

Corel Systems has released *CorelDRAW CD-ROM*, an updated version of *CorelDRAW 2.0*. The \$795 CD-based package includes 3,500 clip-art images from the *ArtRIGHT* Image Portfolios and contains over 7,500 noncompressed images that can be read by any ISO 9660-compliant CD player. It replaces over 30 floppy disks worth of program and image data. The program, which is identical to *CorelDRAW Windows* (First Looks, March 12, 1991), contains the *WFN* Boss typeface-conversion utility, 102 fonts, and *CorelTrace*, a paint program. **Corel** also offers an optical drive SCSI interface that evaluates *Future Domain* and *Adaptec* Connections.



CorelDRAW CD-ROM offers 7,500 non-compressed clip-art images on one compact disk.

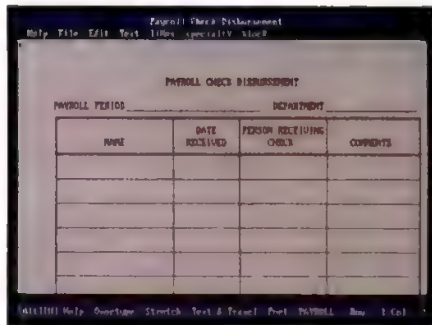
List Price: *CorelDRAW CD-ROM*, Version 1.0, \$795; upgrades from *CorelDRAW 2.0*, \$99. **Requires:** ISO standard CD player, *Windows 3.0*. **Corel Systems Corp.**, *Corel Bldg.*, 1600 Carling Ave., Ottawa, Ontario, Canada K1Z 8R7; 613-728-8200.

CIRCLE 434 ON READER SERVICE CARD

FormGen Adds Spell-Check, dBASE Support

IMPROVED

FormGen Plus, Version 5.5, from **FormGen**, will now read, write, modify, view, and print .DBF files in their native form or convert them to ASCII files for exporting to other applications. Other major enhancements include the addition of a user-modifiable spell-checker with a 60,000-word dictionary, a WYSIWYG form previewer, a clip-art collection, as well as new form and data security features.



FormGen Plus 5.5 comes with pre-designed forms, clip art, and templates.

List Price: *FormGen Plus*, Version 5.5, \$279. **Requires:** 512K, DOS 3.2 or later. **FormGen**, 13 Holland Dr., Bolton, Ontario, Canada L7E 1G4; 416-857-0022.

CIRCLE 436 ON READER SERVICE CARD

Battery Watch Now Monitors All Laptops

IMPROVED

Traveling Software now protects all laptop users from unexpected power loss with the new generic version of *Battery Watch Pro*, its power-monitoring TSR program, as well as offering direct support for 40 popular laptops. The generic power-watch function is a timer algorithm that watches the amount of time your CPU has been on and bases its estimates upon your previously experienced battery capacity.

The new tune-up feature determines the battery's optimal usage pattern by storing the battery's rundown time based upon its last 10 usages. It uses this history to determine a more accurate battery expectancy value. A deep discharge feature to preserve nickel cadmium life and context-sensitive help have also been added.

List Price: *Battery Watch Pro*, Version 3.0, \$49.95; upgrades \$19.95. **Requires:** 14K RAM (6K with disk swapping), laptop computer, DOS 2.0 or later. **Traveling Software**, 18702 N. Creek Pkwy., Bothell, WA 98011; 206-483-8088.

CIRCLE 435 ON READER SERVICE CARD

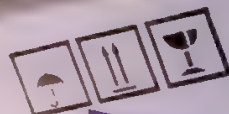
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- 1.2MB 5.25" and 1.44MB 3.5" floppy drives
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Swan 386/33

- Intel 80386DX-33™
- 4MB of 32-bit RAM
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Swan 386/25C

- Intel 80386DX-25™
- 4MB of 32-bit RAM expandable to 16MB
- 64K of SRAM cache
- 100MB IDE hard drive—17ms access
- 1.2MB 5.25" and 1.44MB 3.5" floppy drives
- Swan high-resolution (1024 x 768) video system
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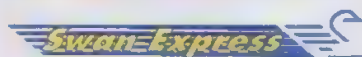
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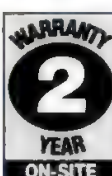


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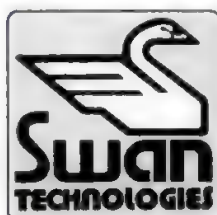
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PC Magazine
9/25/90

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CIRCLE 268 ON READER SERVICE CARD

edited by
Matthew J. Ross

Read Only

Reviews of the Latest Books for the PC User

An In-Depth Look at Intel's 80386 Chip and Personal Computing

Have you ever looked through a bookstore, scouting for that one reference book with all of the information you need, only to be disappointed when you learn that you'll have to purchase at least five books? Well, not anymore, because with Michael Edelhart's *Intel's Official Guide to 386 Computing*, you might not need to buy anything else.

Edelhart, who is the editor-in-chief and publisher of *PC Computing*, has put together a book that covers every relevant topic pertaining to the 386 in an easy-to-understand, yet technical manner. The first few chapters deal with the basics: what the 386 is, how it works, how you configure a 386 system to match your needs, and how you can turn an older PC into a 386-based machine. These chapters provide very in-depth information on all aspects of the 386, such as memory, bus architecture, video adapters, and math coprocessors. One weakness, perhaps, is Edelhart's failure to discuss IDE hard disks in an otherwise complete section on disk storage.

After discussing hardware, Edelhart then moves to DOS- and 386-based software and explains the transition from DOS to Windows 3.0 applications, and programming 386 PCs. Acknowledging the great difficulty that some installations of Windows 3.0 can cause, he gives practical information on not only what Windows is capable of, but also how to get the environment to do it. A thoughtful chapter on Unix explains the operating system in its various flavors on a 386, and then it's on to a very popular



topic at this time—networks.

The chapter entitled "Getting the Most from Networks with the 386 Chip" tells you how to do just that. It not only covers networks from a server angle but also covers performance issues for PC workstations. It discusses the various network operating systems that will allow you to take full advantage of the 386 chip, as well as a variety of other issues that might affect your network.

Intel's Official Guide to 386 Computing breaks down every subject it covers into its most basic units, telling everything you might ever need to know (including complete address and phone listings for 386-specific software and hardware) about the topic it's covering. If you have a question, any question, on the 386 processor, the answer is probably here.

—Wendy Dugas Pérez

Intel's Official Guide to 386 Computing

by Michael Edelhart
\$29.95. Osborne McGraw-Hill,
Berkeley, CA 94710; 800-227-0900.
ISBN: 0-07-881693-9

CIRCLE 396 ON READER SERVICE CARD

Everything You Wanted to Know About Hardware

If you didn't already suspect that there's a lot to know about setting up and taking care of PCs, John Woram's *The PC Configuration Handbook* makes the point resoundingly. It is an almost exhaustive reference for anyone who wants to fix, maintain,

Edelhart Teaches with Thoughtful Analogies

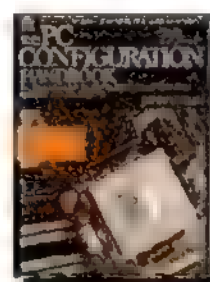
To understand pipelining, think of a bucket brigade. Microprocessors that are not pipelined, such as the 8088, are similar to a bucket brigade with only one bucket. The bucket must be filled with water, passed down the line, passed back up the line, filled with water again, and so on. In an actual brigade, all the operations go on at the same time. That's the way opera-

tions work within the 386. While the Execution Unit is performing instructions, the Prefetch Unit is pulling more data from the Bus Interface Unit, which in turn is moving data from the system bus. Because of pipelining, a 386 can execute an instruction in about half the time it would take a similar processor without pipelining.—*Intel's Official Guide to 386 Computing.*

upgrade, or just learn a whole heckuva lot about the internal workings of the hardware side of personal computing.

The book's subtitle, "A Complete Guide to Troubleshooting, Enhancing, and Maintaining Your PC," states Woram's purpose and helps identify its audience. If you've never opened a computer case and don't intend to, this book isn't for you, but if you've ever looked inside out of curiosity or to install a single upgrade board, sooner or later you will need this book. It's not a component repair manual, but rather a reference to use when adding new computer components or trying to diagnose a faulty system before calling in the service technicians.

Woram starts out with a strong section on computer diagnostics and then methodically works through every hardware component in a PC, including memory configurations, hard and floppy disk drives, monitors, video graphics adapters, printers, and modems. He covers PC, XT, AT, PS/2, 386-, and 486-based computer systems with specific reference to ISA, EISA, and Micro Channel expansion bus architectures.



Appendices include a guide to DOS 5.0, a glossary of computer terms, and—worth the \$26.95 price in its own right—a complete list of IBM error codes and what they mean.

The PC Configuration Handbook is meant to be used rather than idly perused or read through cover to cover. The book is replete with reference tables, charts, diagrams, and photos, and hundreds of topics are covered clearly and succinctly.

Woram's writing style helps you to use the information that you need once you find it. Rather than spending a lot of time re-explaining theory and concepts five different ways, he typically tells you what you'll find, why it's there, what it does, and how to tell if it isn't working correctly. *The PC Configuration's* content and organization make it a worthwhile addition to your arsenal of tools; it's bound to be well thumbed in time.

—Bruce Brown

The PC Configuration Handbook, Second Edition

by John Woram
\$26.95. Bantam Books, New York,
NY 10103; 212-765-6500.
ISBN 0-553-34947-3

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Micro Channel Manifesto Champions IBM's New Bus Architecture



The bus war between IBM's Micro Channel architecture (MCA) and the Extended Industry Standard Architecture (EISA) rages on. Both camps are battling for the corporate and consumer minds of the post PC AT world. From the Micro Channel camp comes a new salvo, *The Micro Channel Architecture Handbook*, a spirited manifesto and white paper for the MCA way.

Chet Heath, IBM senior engineer and principal designer of the Micro Channel, and Winn L. Rosch, an accomplished PC journalist, do an exemplary job

of explaining and selling MCA. *The Micro Channel Architecture Handbook* is the first cross-sectional look at MCA for a wide audience, ranging from the curious PC user to the PS/2 card designer. Heath and Rosch write in a cogent and energetic style; analogies abound, making difficult topics, such as Direct Memory Access (DMA) channels, interrupts, and bus arbitration understandable.

The first six chapters provide an overview of the philosophical, technical, and electrical design innovations of the Micro Channel. The authors then account for the rationale behind IBM's break from the AT bus architecture. Heath and Rosch spell out the

electrical restrictions plus the DMA assignment and interrupt-sharing problems of the AT bus.

Heath and Rosch back up their overview of MCA's advantages. They describe how MCA resolves the PC AT bus's data bottleneck problem with the case of slow printing. Examples of bus mastering or using a DMA channel as a printer port show how MCA takes the load off the microprocessor, allowing expansion boards to work independently of the CPU for improved performance.

The authors then proceed to demystify how the MCA expansion bus works. Important topics given in-depth coverage include Programmable Option Select (POS), an automated setup procedure that eliminates jumpers and DIP switches; level-sensitive interrupts, which allow a single interrupt to be shared by multiple expansion devices; and bus arbitration that removes the

microprocessor from the expansion bus. The bus then becomes a self-contained system that accommodates and controls the needs of multiple devices. All this occurs without slowing down the CPU.

The book's use of the PC AT bus architecture as a comparison point to extol MCA's benefits are useful, but don't address MCA's true competition, EISA. Heath, a 20-year IBM veteran, obviously has taken his loyalty vows. We can only hope that Rosch will balance the scales by providing a similar treatment of the EISA bus.—David Angell/Brent Heslop

The Micro Channel Architecture Handbook

by Chet Heath and Winn L. Rosch
\$29.95. A Brady Book, Simon & Schuster Inc., New York, NY 10023;
800-6240023, 212-373-8093.
ISBN: 0-13-583493-7

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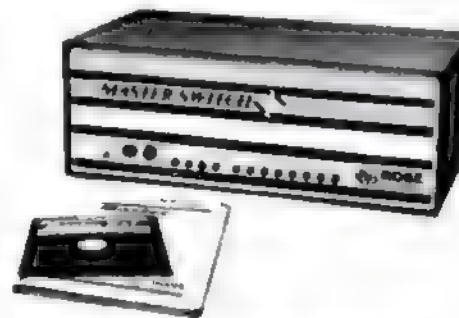
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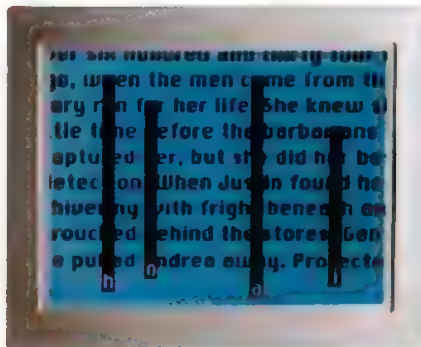
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edited by
Trudy Neuhaus

Toolkits

Reviews of the Latest Tools for the PC Programmer

286/DOS-Extender: Build Protected-Mode Apps for DOS

Phar Lap's new 286DOS-Extender SDK allows the software developer to leave the traditional DOS 640K barrier behind, without requiring users to learn a new operating system. You also don't have to forsake the advantages of the standardized DOS disk formats and the established DOS distribution channels. The Phar Lap SDK can be used with a Microsoft-compatible macro assembler or Microsoft's Optimizing C Compiler to build multimegabyte 16-bit protected-mode applications that run under DOS 3.0 or later on any 80286-, 80386-, or 80486-based IBM-compatible PC. The 286DOS-Extender is compatible with all of the currently popular schemes for management of extended memory: XMS (extended memory specification), VCPI (virtual control program interface), and DPMI (DOS Protected Mode Interface) in *Microsoft Windows 3.0*.

Like all other DOS extenders, 286DOS-Extender provides a protected-mode counterpart to the real-mode DOS and ROM BIOS software interrupt interfaces (INT 21h, INT 10h, and so on). Although this allows a properly segmented MASM program to be converted for the 286DOS-Extender quickly, programs written in C present a thornier conversion problem; real-mode C runtime libraries are notorious for their self-modifying code and misuse of segment registers, not to mention the pointer arithmetic found in the real-mode C huge model, which is incompatible with protected-mode virtual addresses. In the past, DOS extender vendors have coped with this prob-



lem by supplying alternative runtime libraries that have been cleaned up for protected mode. But this solution means tracking each new release of the various C compilers and typically forces the DOS extender devel-

oper to become a developer of protected-mode debuggers as well.

Phar Lap looked at the C runtime library and debugger problem and solved it in a novel way. Knowing that Microsoft C has been distributed as a single package containing both DOS (real-mode) and OS/2 (protected-mode) versions of the compiler, linker, libraries, and debugger for several years, Phar Lap set out to build a DOS extender that would run character-based OS/2 executables. More specifically, 286DOS-Extender contains a program loader and dynamic linker that can, together with the dynamic link libraries (DLLs) that are also supplied by Phar Lap, load an OS/2 application and then trap all of its OS/2 function calls, either handling such function calls completely within the DOS extender and its DLLs or converting them to equivalent MS-DOS function calls. In other words, Phar Lap has turned the concept of OS/2's DOS compatibility box on its head by creating an OS/2 compatibility box for DOS!

The implications of Phar Lap's approach are extraordinary. To build a 16-bit protected-mode application for DOS, you merely compile it with Microsoft C under DOS, specifying that an OS/2 program should be built by including the -Lp switch on the compiler command line, and then execute the resulting file on DOS with the aid of the 286DOS-

Extender. To debug your protected-mode program, just load the OS/2 version of Microsoft CodeView using the 286DOS-Extender, and then run your application under the control of CodeView. Is your program too big to compile with the real-mode version of Microsoft C? No problem: Run the OS/2 version of the Microsoft C compiler on top of 286DOS-Extender and the compiler's memory problems disappear. To be sure, 286DOS-Extender's mimicry of the OS/2 programming interface is not complete. For example, threads are supported but their dispatching is not preemptive, most of the interprocess communication facilities are absent, and device monitors are missing. But the

Phar Lap was the first company to ship a 32-bit DOS extender for 80386-based computers (386/DOS Extender), and its 80386 assembler (386/ASM) and linker (386/LINK) have become industry standards. With the release of the 286DOS-Extender, Phar Lap has broadened its product line to embrace the full spectrum of protected-mode programming for DOS, and has brought protected-mode application development within the easy reach of every Microsoft C owner. Furthermore, Phar Lap has provided a welcome escape hatch for OS/2 ISVs who spent time and energy developing OS/2 character-based applications, only to watch OS/2 fizzle away. The previous owners of the 16-bit DOS

Phar Lap has turned the concept
of OS/2's DOS compatibility box
on its head by creating an
OS/2 compatibility box for DOS.

amount of OS/2 functionality that is made available on a DOS substrate is nothing short of amazing.

The SDK documentation is divided into three perfect-bound, professionally produced volumes. Phar Lap's usual attention to detail and devotion to accuracy are evident throughout the documentation and example programs. Of course, no one is immune to the pitfalls of rushing a product to market by developing the software in parallel with the documentation, so the manuals in my copy of the SDK were accompanied by a six-page list of errata that will be corrected in subsequent printings.

extender market, Rational Systems and Ergo Computing Solutions, will need to scramble to keep up; this competition will benefit all of us.—Ray Duncan

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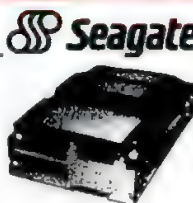


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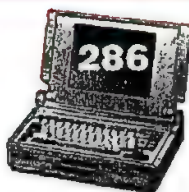
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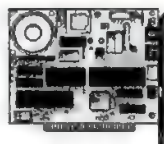
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NETWORK file recovery *File Save must have been installed prior to data loss.	YES*	NO	NO
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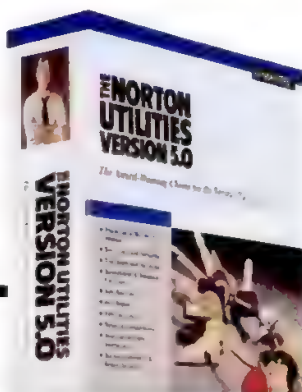
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Bill Machrone



The Emperor's New Operating System

Microsoft has thrown down the gauntlet in operating systems. It wants it all: desktops, servers, workstations, pen-based systems, and things that haven't even been invented yet.

Forget DOS. Forget OS/2. Forget *LAN Manager*. Forget *NetWare*. Forget Unix. But don't forget *Windows*. That's what Microsoft will ask you to do in the coming months and years. Its long-range goals, as espoused in the Strategy Seminar earlier this year, are at once disturbing, reassuring, and electrifying.

I'm disturbed at the cavalier dismissal of OS/2, which has essentially become a proprietary IBM operating system aimed at solving its uniquely thorny client-server and micro-to-host operating system problems. I'm reassured that Microsoft is thinking creatively about DOS's future, a far cry from just a year ago,

when it had been remanded to a future of minor maintenance releases. I'm thrilled at the bold thinking that's gone into this latest revision of Microsoft's world view.

The short-range stuff is well known: DOS 5 and *Windows* 3.1 soon, OS/2 never.

Well, not never, but the next OS/2 from Microsoft will bear little resemblance to the versions we've seen to date. OS/2 3.0 will feature a "New Technology" (NT) kernel, full *Windows* support,

portability, distributed processing, and POSIX (government-flavored Unix) support. The development team is headed by Dave Cutler, the guy formerly responsible for VMS at DEC.

Microsoft's OS/2 3.0 will be a small kernel, with multiple APIs. Ninety-nine percent of it is portable C code. The NT system architecture is intended to meet the government's C2, B-level multiuser security contexts. That's secure. It's also designed to be fault tolerant, supporting disk mirroring, and a transaction-based recoverable file system. The networking capabilities are integrated, meaning that you won't need a file server, but can just hook two or more machines together and they'll find each other and begin sharing data.

Processing services will be distributed and physical location won't matter, for either programs or data. NT is also a symmetric multiprocessor design, meaning that it will allow threads across processors. According to Mi-

crosoft, it's already operational on the 386/486 and is being ported to various RISC processors. Given the recent activity at Compaq, one of them is obviously the MIPS chip.

If the microprocessor is the minicomputer of the nineties, this is its operating system, or so Microsoft hopes. From Microsoft's preliminary description, OS/2 3.0 will be the Veg-O-Matic of operating systems. By covering PC, workstation, server, connectivity, and Unix in a high-performance kernel, it will seemingly be the operating system that no one can say no to.

CONNECTED DOS AND NOVELL

Microsoft believes that the client-server model has a limited future, or is just a way to implement access within a peer-to-peer model. If they can make this work, there'll be little reason to buy *NetWare*, *LAN Manager*, or any other client-server operating system. That thinking goes all the way down to DOS, and here's why: The average Novell network is only 7 to 10 nodes. Among *PC Magazine* readers the number is more like 13, but that's still a far cry from the 200- and 300-node LANs the manufacturers like to tout. Given the



ILLUSTRATION: KEN CONDON

complexity of *NetWare* 286 and *NetWare* 386, connecting so few machines is a bit like killing a fly with a cannon. A simple peer-to-peer network such as *LANtastic* is more than sufficient and is far kinder to system resources, taking only 10K on a typical node and 40K on a machine functioning as a server. Count on a future version of DOS, perhaps Version 6.0, having peer-to-peer networking built in.

Novell's situation would be precarious if it



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Bill Machrone

had a serious competitor. The low-end LAN vendors are simply not in a position to set industry standards. Microsoft has floundered around with *LAN Manager* for years. IBM is too caught up in its own underwear of host connectivity to set desktop networking standards, and Banyan is out of it. Novell, however, is seduced by the same number that keeps Bill Gates smiling: 60 million DOS machines. There will always be more clients than servers, and if client-server architecture takes a back seat to distributed peer-to-peer, Novell could wind up with the fuzzy end of the lollipop. So it is testing the waters to see if anyone is interested in Novell's offering a DOS-compatible desktop operating system. It stands to reason that connectivity would be built-in and that it would likely be peer-to-peer. Reaction has been slight so far, but it's doable.

If I were Novell president Ray Noorda, I'd buy or do a deal with Digital Research. DR-DOS is arguably better than MS-DOS in a number of ways (although Microsoft is rushing to even things up). I'd build in the connectivity my customers want, peer-to-peer with special consideration given to *NetWare* file servers on the same network. Selling it would be tough, because Microsoft enjoys an enormous advantage by being sold at the OEM level. It'd have to be very inexpensive, less than \$100.

Meanwhile, Microsoft is waiting in the wings with a future version of DOS that'll have installable file systems as well as the aforementioned peer-to-peer connectivity and the 32-bit version of *Windows*. It'll be replete with OS/2 features such as preemptive multitasking and multiple threads of execution. It'll also have a flat, 2-gigabyte address space for applications and will take full advantage of the 80386 architecture. Each task gets its own protected memory segment. Each DOS task resides in a separate memory space, too. Thus it should be robust and highly resistant to the Unrecoverable Application Errors common with *Windows* 3.0. Indeed, the only applications that will share a common memory space are today's existing 16-bit *Windows* apps. We should see *Windows* 4.0 sometime in 1992.

No one seriously questions Microsoft's supremacy on the desktop, though its plans for higher-end systems are breathtakingly bold. This is going to be fun. ■



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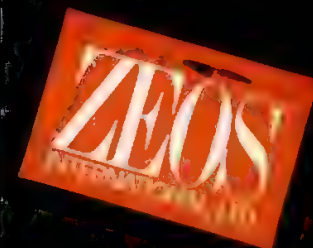
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John C. Dvorak



Our daughters and sons have burst from the marionette show leaving a tangle of strings, and gone into the unlit audience.—Maxine Kumin

The wireless LAN is happening, but is it going to kill us? Or blind us? Literally?

The battle between wireless infrared networks and RF (radio frequency) networks will be won by RF since it does not require "line-of-sight" transmitting to work, and signals can't be as easily interrupted. It's also faster. According to Forrester Research Inc., a Cambridge, Mass., consulting firm, the number of wireless LAN systems shipped in the United States will increase from 2,000 in 1990 to 45,000 in 1995. There is a growing concern that our bodies are already saturated to the max with RF, and the health ef-

Sick of Wire? Sicker with No Wires?

The emissions from new wireless LANs have a lot of people worried. Maybe their bosses aren't causing all of the headaches at work after all.

fects may not be good.

Before you get too wound up with wireless technology, pay attention to the mania over electromagnetic radiation that resulted from articles in the *New Yorker* and elsewhere. For all practical purposes, but without hard evidence, a lot of people have been convinced that the magnetic fields emanating from a VDT cause birth defects and cancer. Now laws are being considered to ban certain monitors. The city of San Francisco, bolstered by office worker unions, passed an anti-VDT law requiring old equipment be removed and new "safe" equipment installed.

The "plug-and-play" phenomenon will only make the situation worse. Most of the wireless systems being introduced are sold over-the-counter, advertised as simple plug-and-play replacements for wires. While with infrared systems this may not be a big deal, it can prove dangerous with RF methodology.

Cellular pocket phones are another concern. They are restricted in power because the antenna of such units is only a few inches from the brain and eyes of the user. It's already been shown that a few additional milliwatts can cause cataracts. The U.S. government has cut

the acceptable exposure level from 10 milliwatts per square centimeter to five milliwatts. Evidence produced elsewhere has resulted in stringent limitations, as low as 1 milliwatt per square centimeter in eastern Europe.

Cataracts may only be the tip of the iceberg. According to research unveiled in 1987 by the Johns Hopkins Wilmer Eye Institute, low-level microwaves may cause another kind of eye damage, killing the cells that line the cornea, causing blurred vision.

While Motorola, NCR, IBM, and others are pushing the wireless LAN in the office, Apple Computers is petitioning the FCC to set aside a portion of the radio spectrum for wireless personal computer networks. Apple calls the new class of communications Data Personal Communications Services, or Data-PCS. It's asked the FCC to reserve 40 MHz in the 1,850 to 1,990 MHz band for Data-PCS, a "plug-and-go" unlicensed system utilizing 1-watt transmitters sending RF through most walls and covering a 50-meter radius. If this petition is granted, every computer maker will jump into this technology.

One watt from one source isn't a lot of power. Radio waves dissipate quickly and

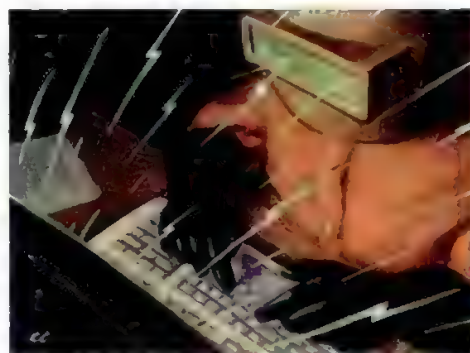


ILLUSTRATION: KEN CONDON

geometrically from the source. But with a possible safety limit of 1 milliwatt per square centimeter in an office with hundreds of machines, each equipped with 1-watt transmitters, you have to wonder about safety. If wireless technology is going to happen, these issues must be thoroughly addressed, soon. If there is even a remote possibility of a safety hazard from the wireless RF LAN technology, expect it to be exploited with the usual spate of lawsuits, dubious laws, and employee unrest.

All this was generated by Word for Windows.

"Word for Windows sets the standard among Windows word processors...remains the product to beat in the Windows environment."

—InfoWorld, January 7, 1991

"A session with Microsoft Word for Windows can make you rethink the whole category of word processing software."

—PC Magazine, December 11, 1990

"Word for Windows is the leader of the pack."

—InfoWorld, February 4, 1991

"Companies would be wise to choose Word for Windows, which most

likely will become the standard for Windows word processing."

—PC Week, December 24, 1990

"Word's collapsible outlining and easy-to-manage formatting via style-sheets should now have been emulated by every other word processor, but nothing else comes close."

—PC Magazine, December 11, 1990

"...it is amazingly easy to learn and use."

—InfoWorld, January 7, 1991

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Inside Track

Is Apple getting into the act? According to participants in recent focus groups held in the San Francisco area, Apple is planning to bring out a computer to compete with the **386/486 clones**. Compaq and IBM look to be the **specific targets** of the machine. Apple hopes to offer both Macintosh compatibility and MS-DOS compatibility and may use DR DOS and its new System 7 operating systems to do it.

Apple can accomplish this dual compatibility in a number of ways. It can offer a **PC-on-a-board** that would interface to the Apple operating system and become an icon on the desktop. None of the Mac's ease of use would be **sacrificed** and the PC's performance would simply be determined by the innards of the add-in card. The Macintosh II systems use a Nubus technology that is amenable to such a product. **The key** is for Apple to **low-ball** the add-in card so the entire system cost would be competitive with IBM and Compaq pricing. Apple, for some time, has already incorporated a capability for its 3.5-inch drives to read IBM format disks, by the way.

To **save money**, Apple may employ an updated version of a software emulator called SoftPC, which does an **adequate** job of emulating a PC on a Mac.

While all this goes on there are **intrigues in Silicon Valley** concerning Apple. These may account for a recent Apple **stock run-up**. One source tells me that **IBM and Apple** have some sort of "deal" going on, but none of the insiders I've talked to recently knows what this "deal" really is.

At the same time there's talk about **Sony doing a "deal"** with Apple. Already Apple is a heavy user of Sony monitors and disk drives. It's expected that Sony will do a **joint venture** with Apple for a lightweight portable Mac. But there is an indication that something bigger may happen. Sony has traditionally been an IBM clone maker and perhaps the connection is the **PC compatible** my friend saw at the focus group.

A Trend We're All Missing Dept.: While we oooh and ahhh over the current OOPS languages, the micro world continues to overlook the programming language that **dominates** the medical world. It can be used to develop commercial applications with such efficiency that one observer **criticized** the language, saying: "Its ease of programming is not always advantageous because programmers tend to write new applications rather than to modify old ones." **Some complaint!**

The language is **MUMPS**—Massachusetts General Hospital Utility Multi-Programming System—invented by Neil Pappalardo and Curt Marble in the late 1960s on a PDP-4.

Years later, the language was **suppressed by frightened COBOL users** when it was introduced to the VA hospital system.

According to one report, computers running MUMPS were actually **confiscated** until Congress intervened.

MUMPS was designed to easily create a hospital information system and has been overly associated with medicine. It's really an all-purpose language/database system. Now it's available on **Unix and MS-DOS** systems as well as other mainframe and mini systems. There's even something called M/SQL from Intersystems in Cambridge, Mass., that supports MUMPS and SQL for report generation purposes.

And IBM announced something called **IBM MUMPS/VM, Version 3**, that allows existing applications developed in ANSI-MUMPS to run on System/370 processors with little or no modification. **A portable language indeed.**

The newest version of MUMPS (ANSI X11.1-1989) has all the characteristics that you want in a **modern language** and development system. This includes facilities to communicate with other non-MUMPS routines and applications. MUMPS promoters say they have studies that prove that MUMPS requires **only 8 to 12 percent as much development time** as other languages.

If there is little knowledge of MUMPS in the business community it seems to be because of poor public relations and the fact that MUMPS doesn't have a Micro-

soft or a Borland to shove it **down the coders' throats**. Call the MUMPS Users Group at 301-779-6555 for more information. Do it today.

Genuinely Interesting Software Dept.: Scratch the surface of *Microsoft Windows 3.0* and do you have nothing more than a **fancy menuing program**? From the user's perspective, this might be **true**. At least that's what you'd think if you bought a copy of *TitusDOS*, a \$49.95 GUI menuing program that **looks like Windows** and uses public domain *Windows 3.0* icons. It's the funniest thing I've seen since, uh...*Office Vision!* You **click on an icon** with a mouse and off you go into some program just like *Windows*. Only these are DOS apps. Also included in the package is a text editor, telephone book, calculator, and calendar. You'll also find a **bunch of handy DOS utilities** within the *TitusDOS* environment such as a format program, rename utility, and other things to eliminate the need to reenter "pure" DOS. This is one of the most interesting menu systems **I've ever seen**. Check it out. It's from Titus Communications Corp., 1001 Ross Ave., Dallas, TX 75202; 214-954-0630. ■

According to participants of recent focus groups, Apple will bring out a DOS-compatible 386 computer to challenge Compaq and IBM.

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—Computer Shopper, 2/91
Reviewer: Gregg Kelzer

"End-users voted EPS SX and 486 systems Reader's Choice Awards for all of 1990."

—Computer Monthly, 2/91
Reader's Choice Awards

"The EPS 386-33 is a machine that is bursting with promise. On paper and in our tests the machine gives up nothing to its competitors. EPS is committed to the long haul."

—PC Magazine, 12/25/90
Hardware Review: Fredric Burke

"The EPS 80386/25 is a lot of machine for the money, and the service is outstanding. It has probably the best money back policy in the business and is a top-of-the-line machine all the way around."

—Computer Buyer's Guide, 6/90
Hardware Review: Ron Albright & Joey Bruno

"EPS is as strong an organization as they are smart. Concern for detail is found throughout the EPS. It ran faster than many other SX machines. The system was flawless in software compatibility and a pleasure to use."

—Computer Monthly, 12/90
Hardware Review: Douglas E. Kilarski

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**TEXAS
INSTRUMENTS**

Jim Seymour



Fascist Software and the 'Violate' Key

Even programs smarter than we must submit to the will of creative users when the need arises.

One of the hallmarks of good software design is the programmers' effort to save us from ourselves.

Good programs go out of their way to keep us from producing bad results. The idea isn't new: Error trapping in databases, for example, has been around for a long time. DBMS programs have long been able to catch input errors, from Social Security number entries with too many digits to nonexistent dates like May 37, 1942.

Another approach anticipates bad things before they happen. *Microsoft Word*, for example, has a "nearly out of memory" flag.

Ignore the "Save" warning for a few hundred keystrokes and it starts blinking. Only the most reckless user continues past that without a memory-clearing save.

My favorite kind of user-protective design brings what I'd call real-world rules into play. *Harvard Graphics*, for example, tries to keep its users from producing ugly output.

Harvard "knows" about relative type sizes in multiple-line chart titles; for example, it "knows" where and how explanations of the y-axis ("000s" and "in thousands") and chart footnotes ("Source: XYZ") should appear. It puts those elements in the right place, in a typeface and type size that will look good, within whatever overall design and typeface choices users make.

In the world of presentation graphics, where many business people feel uneasy about their ability to produce something both graphically attractive and effective, that kind of helping hand is invaluable.

But as software and PC users both evolve, what once seemed to be boons come to feel like burdens, limitations on our ability to work *our way*.

MANUAL OVERRIDE

Recently I spent a day with a group of graphics software designers, talking about what we like and don't like about software. We discussed protecting users from themselves, and both they and I had some pretty firm notions of what

we want and the problems attendant to delivering those functions.

The developers spoke about their fear of creating "fascist software"; I brought up my long-held desire for a "violate" key. In fact, we were talking about the same problem: how to build enough smarts into a program to guarantee good-looking output, without cramping the style of the user who knows enough to break the rules.

"Fascist software" is a great phrase. We've all run into programs with such narrow views of how the world should work that we have found ourselves tied up in knots trying to learn its style—or more likely, how to beat it into submission so we could work *our way*.

The developers of those programs thought they were doing us a favor: They had a vision about how things should work, and they were going to deliver that vision to us.

A benign form of fascism, perhaps—if that makes sense—but a literal, right-out-of-the-dictionary one. It's an approach that goes against the notions of interactivity and user-empowerment that lie at the heart of the success of the PC in our culture and time.

But often that approach was taken not be-



cause the developers believed there was only one way to work, but because they were trying to guarantee that their program would deliver results that met industry standards or societal or linguistic conventions.

A spell-checker that changes your spelling from *wierd* to *weird* is not fascist. An accounting program that produces results in accordance with generally accepted accounting principles is not fascist.

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Jim Seymour

So principles of logic and consistency are at work here, too.

A good example: I use outlining programs to organize masses of raw ideas. I throw the ideas in as fast as I can type. I tuck some under other ideas to which they clearly seem subsidiary, and others I tuck in under *those*, to create hierarchies of ideas. Most just get stacked at the left margin, as top-level ideas.

But the minute I finish that list and read over it, I see how wrong I was. There are complicated relationships—clear links and hierarchies—I never understood until I saw the finished list. So I start hauling things around, demoting this a level or two, pulling that up from a third-level subtopic under item G to a top-level heading all its own.

Most outlining programs don't make it that easy. They want to maintain the flawed hierarchies I *thought* existed when I typed the information in. They do not like it when I blithely promote something from deep down in a sub-sub-sub-sub-category to the top-most level. Nor when I try to drag a top-level idea, *without its subtop-ics*, down to subitem status.

That's fascist software.

Sure, the program was just trying to respect the relationships I originally thought I saw among the items. But I didn't *want* to hold onto those hierarchical relationships: I'd gotten them wrong.

Graphics programs that make it hard to get noncentered titles, to display legends my way, or to do whatever else I want on a graph or chart, suffer from that same infuriating *fascisti* mentality.

FIGHTING THE FASCISTS

My answer: Every program that includes rules on how things should be done should also include a "violate" key—a key which, when held down, allows a user to do whatever he or she damned well pleases. It could be Ctrl or Alt, or maybe a chording combination, such as Ctrl + Alt; I don't particularly care.

As programs include more and more well-intentioned, useful rules about how things should work, they also need an *escape-the-rules* option for users who occasionally want to apply their own rules.

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Exhibit A: The Shot. Rick Muller's
masterpiece to the right. We call it
'Color Separating.' Captured by Nikkor
optics, it was scanned on the LS-3500.

Exhibit B: The Reviews. "★★★★½"
[The LS-3500] wins overall for flexibil-
ity in resolution and for the wide range
of controls it offers," said MacUser.*
To quote a MacWEEK comparison, "The
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Exhibit C: The Real
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Exhibit A began life as an
8x10 transparency. Also note
that the LS-3500 performs equally well
with negatives and monochromes. So,
ultimately, the format of your source
material is largely immaterial.

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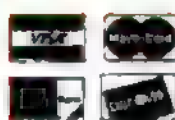
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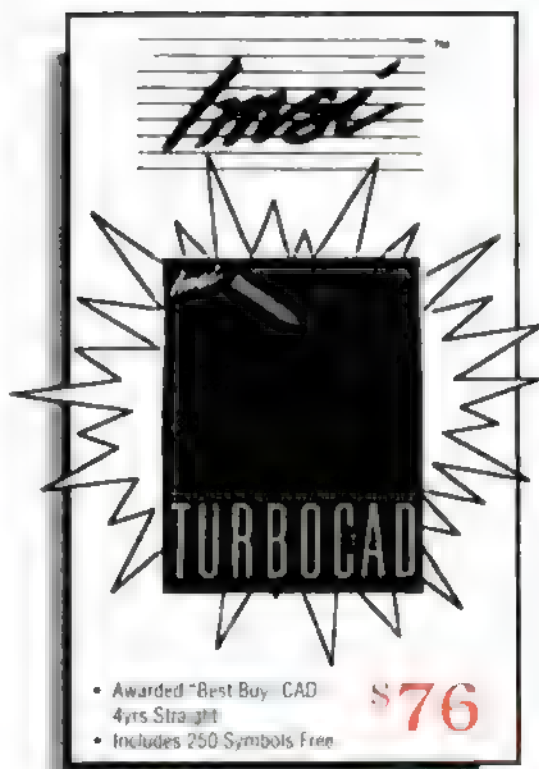


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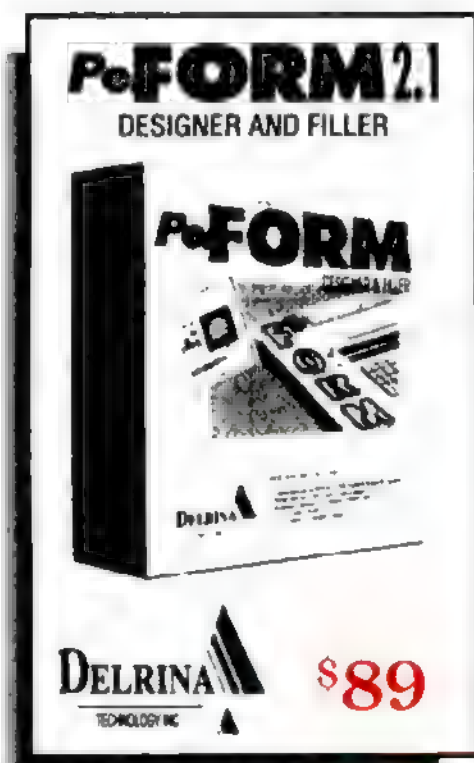
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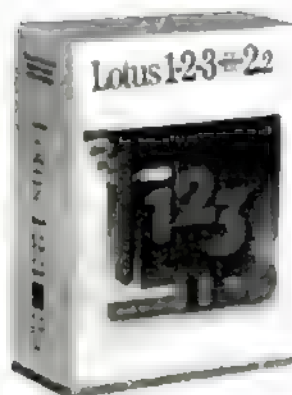
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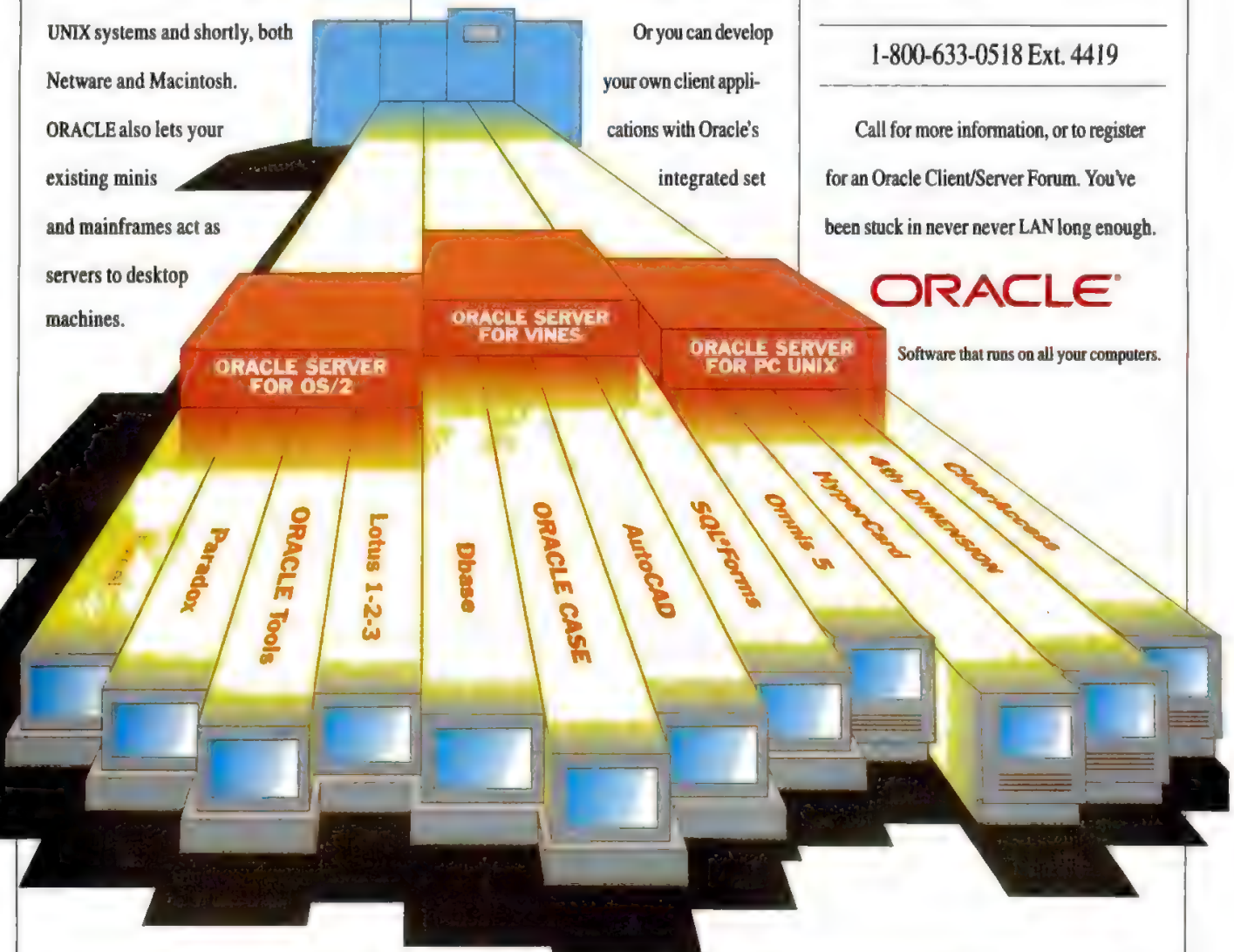
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Windows, Now and Forever?

Rumors of OS/2's demise have been greatly exaggerated.

Is OS/2, Version 2.0, doomed in advance to failure? Earlier this year, the industry consensus seemed to be that *Windows* and the *Windows* Application Program Interface (API) make OS/2 2.0 and its 32-bit Presentation Manager (PM) API irrelevant. OS/2 2.0, the reasoning goes, is merely an elaborate last gasp for OS/2 PM, destined to be embraced by a small coterie of PM diehards and ignored by the world at large.

In the *Windows*-centric view of the world according to Microsoft, OS/2 2.0 amounts to little more than a minor diversion. The message to both developers and users, spelled out at Microsoft's Systems Strategy Seminar in January, is clear enough. "Forget about OS/2 2.0 and stick with *Windows*," Microsoft seems to be saying, "until we deliver OS/2 3.0 and the 32-bit *Windows* API for it in 1992."

True, Microsoft remains pledged to provide OS/2 2.0 to OEM customers. And they will offer continued support for OS/2 2.0's 32-bit Presentation Manager API on the "portable" (or "new technology—NT") OS/2 Version 3.0, which will be ready sometime in 1992. But Microsoft has also made it abundantly clear to those who follow the company that the promised 32-bit expansion of the *Windows* API, not the PM API of OS/2 2.0, is their "strategic" API for the future. Future enhancements will be made to the 32-bit *Windows* API rather than the PM API.

Microsoft has, in effect, urged both developers and users to forget about PM and the PM API and to use and write *Windows* software instead. As far as Microsoft is concerned, the PM API might just as well be dropped entirely. This *Windows*-centric outlook has led many to assert—incorrectly—that OS/2 is dead. And many of those who accept Microsoft's soothing assurances that OS/2 is still breathing nevertheless assume that, at the very least, PM API is ready for burial.

It isn't. Microsoft's enthusiasm for the *Windows* API notwithstanding, it is far too early to write an obituary for PM at this point. PM will certainly survive as a viable alternative to

Microsoft's "strategic" 32-bit *Windows* API. And chances are quite good that PM will do much better than merely survive. It may even edge out the *Windows* API, despite everything Microsoft has been saying. Let's take a look at why.

NOT THE DOMINANT ENVIRONMENT

Granted, *Windows* 3.0 is a very nice product and, by any reasonable measure, a very successful one. But *Windows*' success hasn't been nearly as complete as one might conclude from the enormous amount of press attention it has received. Sales of Version 3.0, impressive as they may be, fall far short of the numbers necessary for *Windows* to become the dominant desktop operating environment in the foreseeable future. At least two or three times as many new IBM and compatible systems are sold each month than are copies of *Windows* 3.0. So *Windows* is not even close to saturating the market for new systems, let alone covering the base of some 60 million IBM and compatible systems already installed and in use in the U.S. (at least another 30 million are in use internationally).

Even more significantly, sales of *Windows*



ILLUSTRATION: KEN CONDON

applications continue to lag far behind reported sales of *Windows* 3.0 itself. So either *Windows* sales aren't quite as strong as published reports suggest, or a significant proportion of *Windows* 3.0 owners aren't using the environment. It may also mean that many who are running *Windows* are using it primarily as a glorified DOS multitasker. These users could well be running standard DOS applications, the way one might use *DESQview*, and making

William F. Zachmann

relatively little use of *Windows*-specific applications.

More support for this argument lies in the fact that the majority of *Windows* 3.0 purchasers (over two-thirds, according to Microsoft's own estimates) are running

it on Intel 386- or 486-based systems. These processors are required to run *Windows* 3.0 in Enhanced mode, so they can take full advantage of its ability to run multiple DOS apps.

In fact, despite Microsoft's continued insistence that *Windows* 3.0 runs well on 286-based systems, nearly everyone knows that really productive use of *Windows* 3.0 requires at least a 386 system

with 4MB of memory and a 100MB hard disk. Only very patient people are very happy with *Win* 3 running on typical 1MB 286 systems.

Another *Windows* weakness involves support. Good as *Windows* 3.0 is in many respects, it is a major headache for corporate PC support people. Configuration problems, limitations in handling time-critical communications tasks, the mysterious UAEs (Unidentified Application Errors), and other problems make a lot of support personnel much busier than they want to be.

A LARGE POTENTIAL AUDIENCE

If, in fact, *Windows* is running on many systems simply as a DOS multitasker, then the audience for OS/2 could be very large indeed. OS/2 2.0 promises to provide an even better platform for multiple simultaneous DOS applications than *Windows* 3.0, and it can run on many if not most of the systems already running *Windows* 3.0. It also offers a more stable and reliable platform for communications. In terms of support requirements, it should be no worse—and probably somewhat better—than *Win* 3, because it's inherently a more stable environment. Moreover, *Windows* 3.0 applications that don't run directly on OS/2 2.0 can readily be ported to it.

OS/2 2.0, in short, is better than *Windows* 3.0 at many (if not most) of the tasks for which *Win* 3 is really being used. As a result, it is likely to be far more attractive to *Windows* users than most of those users—and many industry pundits—now realize.

Combine this underappreciated attractiveness of OS/2 with a major marketing push by IBM and you begin to see much brighter prospects for OS/2 2.0 and the PM API. The picture gets even rosier when you consider IBM's growing recognition that OS/2 2.0 cannot succeed if it is perceived as proprietary to IBM's PS/2 systems. Unlike Microsoft's OS/2, Version 2.0, which remains a promise well over the horizon, IBM's OS/2, Version 2.0, is an imminent reality. It is poised—right now—to take over where *Windows* 3.0 leaves off.

Nothing, of course, is certain in life. OS/2 2.0 is by no means guaranteed to succeed. But before mourning the passing of OS/2 and the Presentation Manager API, I think it wise at least to give OS/2 2.0 and PM a chance to prove themselves. Only time will tell. ■

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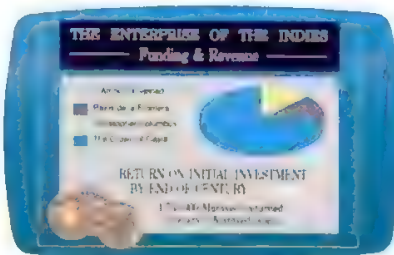
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15 Relational Databases:

Easy Access, Programming Power

by David Kalman

No other business application has more strategic importance to an organization than a database management system. When was the last time you heard of a "mission-critical" word processing application? Desktop database packages are now being called upon to serve on the front lines of corporate data processing, providing services previously delivered on minicomputers and mainframes. At the same time, end users demand easy access to data, and developers want sophisticated environments for building commercial applications.

Today's database software meets these challenges with amazing aplomb, but as you'll see, no single package serves everyone's database needs perfectly. This evaluation of 15 relational database packages is not a contest of sheer features and functions; it is a guide to finding the one package with the right combination of capabilities for your present and future database development.

Which programmable relational database packages provide the best combination of programming finesse and end-user ease? PC Labs puts 15 relational powerhouses through a taxing series of benchmark tests to find out.

COVER STORY RELATIONAL DATABASES

REVIEW CRITERIA

For this evaluation we started with an initial list of almost four dozen multitable and relational database packages and arrived at a final group of 15, priced between \$99 and \$1,000. We searched for relational database packages useful to end users and programmers—in other words, databases to grow with and good corporate solutions.

A package had to be significantly upgraded within the past 18 months and offer an end-user interface that does not require programming for queries and

reporting. More than a dozen packages, such as *D the data language* and *KnowledgeMan/2* require their programming languages for end-user productivity and therefore were not evaluated here. However, the tested packages were required to offer a programming language for professional application development. (This requirement eliminated Alpha Software's popular *Alpha Four* from the review.)

Two packages, WordTech's *dBXL* and

DataFlex's *DataFlex*, were requested for evaluation but were not submitted by their vendors. Two others, Aker Corp.'s *Magic PC* and O'Hanlon Computer Systems' *The O'Hanlon Database Solution*, failed to complete the entire suite of 10,000-record benchmark tests and were removed from testing. (For details, see the benchmark test reports.)

This evaluation does not cover database server products (back ends) such as *SQL Server*, *OS/2 EE Database Manager*, and Gupta's *SQLBase Server*, or client-server front-end packages like Gupta's *SQL Windows*. We do, however, evaluate several packages that double as database server front-ends when the need arises. Packages such as *Advanced Revelation*, *DataEase*, *dBASE IV*, *Omnis 5*, and *Paradox* all provide access to server data by invisibly substituting SQL (structured query language) commands for their own or by allowing users and programmers to issue SQL explicitly. Using these packages to access server data generally requires optional modules.

LOOKING BACK, LOOKING FORWARD

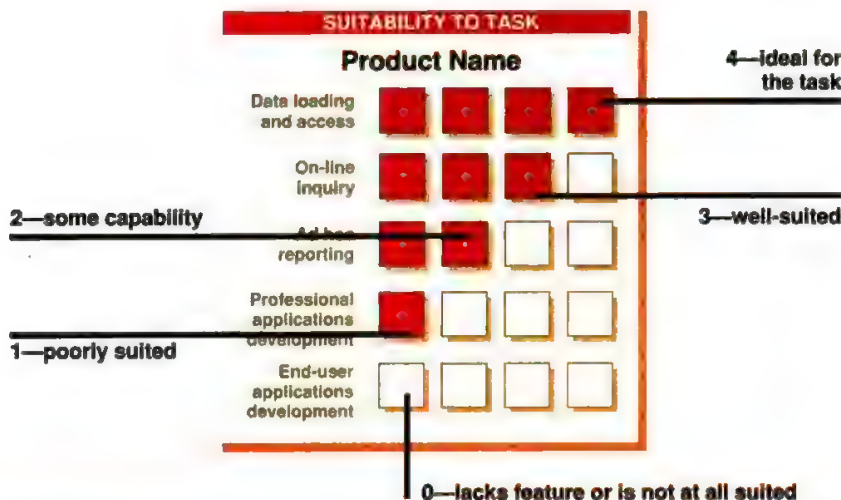
In *PC Magazine*'s last major evaluation of programmable databases, we selected *FoxBase Plus 2.0*, *Paradox 2.0*, and *R:BASE for DOS* as Editors' Choices. Since then, we've seen the version numbers of these packages run up like *Rocky* movie sequels. Unlike movies, however, these sequels only get better.

One particular upgrade, improving on the original version, is Ashton-Tate's *dBASE IV*, Version 1.1. With bugs exterminated, a new memory management system, an integrated disk cache, and a host of new features, *dBASE IV* 1.1 reaffirms Ashton-Tate as a credible force in the PC database market. (See "dBASE IV, Version 1.1: A New Beginning," *PC Magazine*, January 29, 1991.) Coming soon, but not in time for this evaluation, is another important upgrade: Fox Software's *FoxPro 2.0*. We preview it in the sidebar "FoxPro 2.0: New Tools, New Look."

Two of the packages, *Superbase 4* and *Omnis 5*, run under *Microsoft Windows 3.0*. These systems represent the first wave of usable graphics databases for PCs. *Windows* databases have the advantages of being able to integrate pictures and text, to execute functions in dynamically linked libraries (DLL), and to share data with other applications through Dynamic Data Exchange (DDE). It's taken a while for

RELATIONAL DATABASES: SUITABILITY TO TASK

PC Magazine assesses the suitability of relational databases in five areas—data loading and access, on-line inquiry, ad hoc reporting, professional applications development, and end-user applications development—and assigns a point value to each one. These subjective ratings, based on a scale from 0 to 4, are presented along with each review.



To score well in **Data loading and access**, the package should load and index quickly, and the number of supported importation formats should be as wide and varied as possible.

On-line inquiry rates the package's query optimization, its query-language strengths, and the ease of the querying features.

Ad hoc reporting judges how suitable the package is for reporting of all types. It evaluates the report writer, the form-generation features (if any), the flexibility of the output, the mailing-list management/label-printing facilities, headers and

footers (if any), and the ease of use for all these features.

To score well in **Professional applications development**, a package should have strong developers' tools, a debugger, link libraries to other languages, editing, a programming language, a text editor, and good documentation. The question is not just how good the language is but also how useful the tools are in helping you to program.

End-user applications development refers to the quality and usability of a package's end-user tools—its ability to get data in and out without programming.

PCs to become fast enough to handle the combined demands of data processing and graphical user interfaces. But as PCs get faster, it's only a matter of time until GUIs reign supreme.

RELATIONAL REDUX

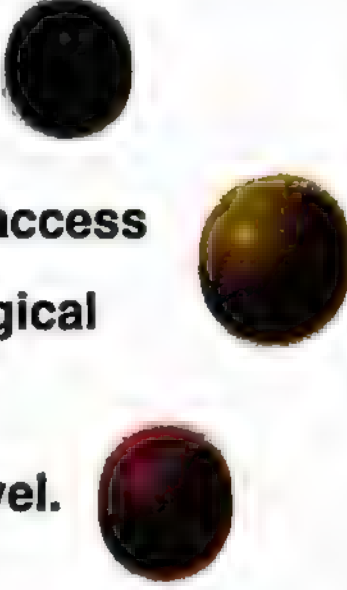
When discussing databases, it's impossible to skirt the issue of relationality—the degree to which a package conforms to E.F. Codd's relational model of database management. The relational model, with its theoretical foundations in first order predicate logic and the theory of relations, proposes 333 features and defines specific rules for what qualifies as an "adequately relational" or "fully relational" database. These qualifications are described in Codd's book, *The Relational Model for Database Management, Version 2* (Addison Wesley). The issue of relationality invites controversy since no commercial PC database packages qualify as truly relational, yet many claim that they are. While this helps sales, it ultimately confuses users. In the PC world, the term "relational" has been misused by vendors to describe any system that manages data in multiple tables. Ostensibly, this is intended to distinguish their products from less-powerful flat-file packages.

Certainly, no database package provides all of Codd's proposed features, but a relational database manager should have some basis in Codd's model. A relational database accesses data at a logical rather than physical level, and the user/programmer selects data by names and values, without explicitly navigating records. The system, not the user/programmer, determines the best way to produce the result of a query (this is known as a "nonprocedural" method). In a relational database, every database query produces a set of one or more records. The set is actually a complex data type (called a relation) that is subject to the full range of relational operations. The point is that some multitable databases are relational and some are not.

Both relational databases and simple multitable databases have advantages over flat-file database packages, such as Symantec's *Q&A*, in that they allow users to handle complex data management problems efficiently. In a flat-file database, all the data goes into a single table or into loosely grouped tables. This is somewhat inflexible, since you are limited to a fixed number of line items per record. In

addition, when you use the same vendor more than once, you must reenter the vendor information, wasting time and disk space.

One advantage of the multitable approach is flexibility. You can have as many line items as you want, and you can add reports or processes that use the vendor table without having to modify its structure. Flat-file databases can't adapt as well to change because discrete collections of meaningful data can't be easily derived.



**Relational
databases access
data at a logical
rather than
physical level.**

Another multitable advantage is updatability. When you change an address, for example, the change is reflected in every related place. In the flat-file database, you might change an address in a single record, but looking back you wouldn't know which change was the most recent.

The advantage of the flat-file approach is its simplicity. It works much like the real-world file cabinets that we relate to so easily, but like a file cabinet, the more information you add the more disorganized it becomes. With a multitable database, adding information doesn't equal disorganization.

Among multitable databases there are varying degrees of relationality. The more-relational databases provide comprehensive nonprocedural access to data through the use of SQL, QBE (query-by-example), or equivalent nonprocedural commands. Again, by nonprocedural we mean that the system determines the best file access method, not the programmer or user. These include systems such as *Ingres*, *R:BASE*, and *Paradox*. Others, such as *dBASE IV*, include SQL and QBE to augment their native procedural interfaces but require procedural programming for many operations. Some systems, such as *FoxPro* and *Advanced Revelation*, provide only a few relational features, such as nonprocedural

report writers and query tools, but require procedural programming for all other operations. In general, the more you like to program your own file access methods, the less satisfaction you'll derive from nonprocedural systems. Nonprocedural databases offer advantages in productivity and procedural database languages offer greater flexibility.

ADAPTING TO DOWNSIZING

While the relational databases on the market today are more feature-rich, productivity-enhancing, and powerful than they were three years ago, the real difference is not in the software but in an organization's attitude toward it.

The move by corporations to adopt PC database systems from the top down is on its way. MIS departments are now earnestly implementing LAN-based information systems to supplant traditional mini and mainframe systems (contributing editor William F. Zachmann calls this "downsizing"). As a result, today's PC databases have begun to adapt to the many requirements of the corporate data-processing environment. Those requirements—the preservation of data integrity, the controlled sharing of data with adequate security, on-line transaction processing (OLTP), and transparent access to host data—are no small tricks. The most visible response to these demands has been the widespread adoption of SQL, the ANSI-standard database sublanguage. Widely used on minicomputers and mainframes, SQL serves as a lingua franca for cross-platform database management. PC-based packages such as *DataEase*, *dBASE IV*, *Ingres*, *Paradox*, and *R:BASE* now allow the development of applications that include explicit SQL statements for manipulating server data.

Other database features that have always been demanded by MIS departments—transaction processing, database server connections, and user interface standardization—are dealt with, at least in some part, by packages that have adopted the Common User Access (CUA) standard from IBM's Systems Application Architecture (SAA) strategy. When managing hundreds of workstations in a large corporation, you need to have consistent user interfaces to reduce training costs and improve user accuracy. Packages adhering to CUA-compliant, drop-down menu design and *Windows*-based packages like *Superbase 4* have that advantage.

AN INFORMATION ARCHITECTURE

Assuming that large-scale databases will be managed on LANs by back-end servers such as *Oracle Server*, *SQLBase*, *SQL Server*, and *OS/2 EE Database Manager* (and on minis and mainframes via gateways) in the near future, where does that leave your pure-bred PC database package? The answer is: running applications on your desk, where it belongs. You can

**Consistent user
interfaces reduce
training costs
and improve user
accuracy.**



continue to use the database that fits your niche as long as you keep an eye on the client-server future and can rely on your package to provide all the necessary hooks when the time comes.

A key objective of the relational model is to provide database access at a logical level for physical data independence. This means that users and applications can interact with data without regard to its structure through SQL commands. Diverse applications can access the same data independently, and it becomes possible for PC database packages such as *Advanced Revelation* with "Environmental Bonding," *DataEase SQL*, *Paradox* with SQL Link, and *dBASE IV Server Edition* to share the same databases.

Physical data independence also means that as databases grow, they can be moved to larger systems without the need to rewrite applications. This scalability preserves a growing organization's investment in tools and custom applications.

ENDLESS VARIETY

PC database management systems come in all shapes and sizes. For example, LAN database servers such as *SQL Server* and *OS/2 EE Database Manager* specialize in the administration and protection of data for workgroups. Application development systems such as *Advanced Revelation*, *Clarion Professional Developer*, *FoxPro*, and *dBASE IV* specialize in tools and languages for building applications. Full-featured relational database managers such

as *Paradox* and *R:BASE* excel in providing interactive capabilities and integrated application tools. Graphics database managers such as *Omnis 5* and *Superbase 4* offer tools for building GUI applications that employ scalable fonts and images. In addition, systems such as *DataEase*, *Paradox*, *Advanced Revelation*, and *dBASE IV* double as database server front-ends for the well-managed sharing of corporate data.

To use a traditional database management term, you can "decompose" the database management genre into categories, identifying a package's intended user as well as its functionality. Those categories include:

- programmable application development systems for database programming professionals
- interactive data management and administration facilities for computer professionals
- interactive data management facilities for end users
- application development tools for end users
- database server front-ends
- database servers
- variations/combinations of the above.

Except for database servers and front-ends, you generally won't find these categories stamped on the side of a database box, and while two packages may appear the same on the surface, they may be intended for different classes of users. A vendor may claim to produce a one-size-fits-all system, but it's almost certain that the package has a distinct bias toward a specific data management niche. It's your responsibility to determine the type of user you are. The biggest danger in this process is that users often purchase packages far more complex than necessary because the distinctions among packages are so vague.

HOW WE TESTED THE DATABASES

For the purposes of this review, we do not measure the extent of a database management system's relationality since none of the packages can meet Codd's orthodox definition of the term. Instead, we have evaluated the products' relational functionality—their ability to execute a group of database operations and queries that all relational systems must be able to

perform. Our benchmark tests, a subset of the AS3AP (ANSI SQL Standard Scalable and Portable) Benchmark Test for Relational Database Systems, provide comprehensive tests of database processing power across a broad range of products and platforms.

Although the tests are specified in SQL, the tested products do not need SQL to perform them. Instead, the vendors, who used their own technical experts to code our benchmark test specifications to their packages, have employed their best methods to achieve the same results.

YOUR EVALUATION REQUIRED

Choosing the right database entails extensive planning. Any potential buyer must consider issues of PC and LAN compatibility, performance, ease of use, ease of development, and the availability of ongoing vendor support. Larger organizations must also pay attention to mini and mainframe interoperability, LAN database server compatibility, security features, and long-term support.

In this evaluation, you'll find much of

OUR CONTRIBUTORS

Bruce Brown, Alfred Poor, Winn L. Rosch, and Richard Hale Shaw are contributing editors of *PC Magazine*.

Katherine Emery is president of S-O-F-T Industries, a Southington, Connecticut-based computer management, research, and software development firm.

Henry Fersko-Weiss is a free-lance writer and a frequent contributor to *PC Magazine*.

Gabrielle Gagnon is the software project leader in *PC Magazine Labs*.

David Kalman, the former Editor-in-Chief of *Data Based Advisor* magazine, writes and consults on databases and applications development systems. He is currently working on *The FoxPro 2.0 Developer's Guide* (Bantam).

Sal Ricciardi is a New York-based computer consultant and author of *PC Magazine's Databases* column.

Joe Salemi is author of *PC Magazine's Advisor* column, a frequent contributor to *PC Magazine*, and a PC MagNet sysop.

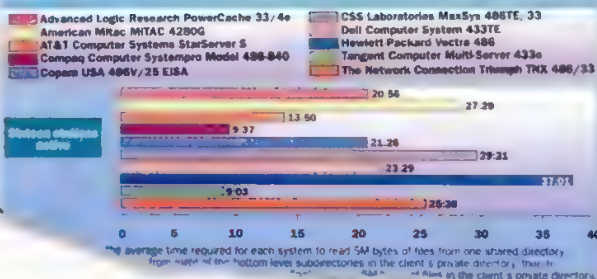
Once again, editors rave about the Tangent 486.

"...when the full 16 stations included in the test were active. The Tangent Multi-Server 433e was still the fastest..."

PC Week 1/7/91

PC WEEK

Tangent Server Maintains Performance Lead As LAN Size Increases



"A consistently strong performer across all tests, the Tangent model 433e stands out in this group." PC Magazine April 16, 1991



April 16, 1991
Tangent 433e

PC Magazine, April 16, 1991

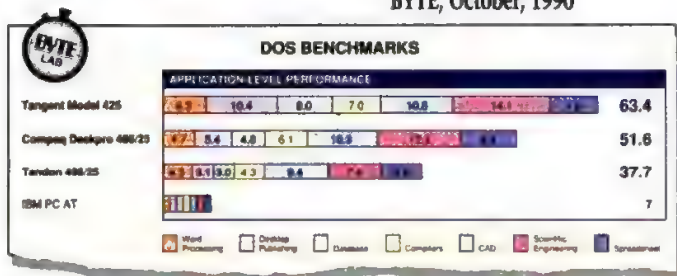
TANGENT COMPUTER INC.

Tangent Model 433e

by Bill O'Brien

Tangent Computer's foray into the realm of the EISA bus is represented by an investment-quality machine.

"The big winner is the Tangent..."
BYTE, October, 1990



When the editors got through writing about Tangent 80486 systems, they didn't leave us a lot to say. Except price. First, compare performance. Then compare price. What you'll see is that Tangent is the price-to-performance leader in 486 systems, with a range of models designed to fit any need.

*All pricing subject to change without notice. ©1991 Tangent Computer. Tangent is a registered trademark of Tangent Computer, Inc. 486 is a registered trademark of Intel Corporation. Other product names may be the trademarks or registered trademarks of their respective companies.



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"A Solid, Complete Machine For The Rest Of The

Weight

It is important for a notebook PC to weigh at least 6-7 lbs. Many of our customers (and even Computer Shopper) who have had experience with the 4-5 lb. "lightweights" all agreed that they are too flimsy. The 6-7 lb. machines offer a much sturdier box and will work out better in the long run.

Keyboard

The layout of a keyboard and the size of the keys make all the difference in the world. Is there a large enter key? Is the "Ctrl" key in one of the two normal spots? Are the arrow keys arranged in an inverted "T" fashion? Is there an external keyboard connector?

Size

How easily will the notebook, along with the AC adapter, fit into a brief case? Specifically, will the notebook fit side-ways into half of your briefcase? Sounds minor, but it's important.

Speed

You can never have too much of this valuable commodity. A 12 or 16MHz machine may be adequate for some uses but Windows users and those who operate in graphics-intensive environments really appreciate the extra MIPS.

Memory

Expansion: Does the computer use industry standard memory (SIMMs or SIPs), or does it use proprietary memory? If proprietary memory: (1) Will the company be around long enough to allow future upgrades? (2) How much does the proprietary memory cost? (3) What happens when a product is discontinued?



\$2650

NB/320SX

20MHz/LCD/VGA

2MB/20MB HD

Expansion

Chassis / Docking Station: Availability of an expansion chassis will effectively guarantee your notebook's future in the event you eventually require a LAN adapter, scanner card, tape backup, or similar peripheral device.

Screen

The good notebooks use the latest triple-twist LCD technology which provides great clarity and excellent readability. Low-end notebooks tend to use the older double-twist screens which will fade out when being viewed from an angle.

I/O Ports

A complete notebook should have at least one parallel port, two serial ports, a VGA monitor port, K/B port for your favorite keyboard, and an internal modem slot.

Battery

In general, a notebook's battery will carry a 2-hour charge or more. Is there a "suspend" button for use when the battery is replaced? How much does a spare battery cost? Recharger?

Return

Policy: Regardless of the ad, make sure the money back guarantee is a no-questions-asked deal. And make them state specifically that there is no restocking fee. You want a couple weeks to see if you feel comfortable with the system. Be prepared, however, to pay the round-trip shipping charges if you choose to return the system.

Price

The big thing here is value. Comparison shop the exact configuration you intend to own in six months. Do not assume that peripherals purchased later will be priced the same by all manufacturers. High-priced additions to a cheap system may reverse rankings made strictly on base prices.

That Sets The Standard Industry...."

March 1991, Computer Shopper

Notebook Buyers' Checklist:

Standard Features	DATAWORLD NB-320SX	BRAND X
Weight	7 lbs	
Processor type	80386SX	
Processor speed	20 MHz	
Base Memory	2 MB	
Floppy drive	1.44 MB	
Display technology	Triple twist VGA	
Display Resolution	640x480, 32 gray scales	
Battery Type	Nicad D-cell	
Parallel port/Serial ports	1/2	
Dedicated modem slot?	✓	
External VGA support?	✓	
External keyboard support?	✓	
Expansion box available?	✓	
DOS included?	✓ (4.01)	
Carrying case included?	✓	
Other software included?	✓ (FastLynx)	
Optional Features:		
Memory upgrade path	4MB, 8MB, 16MB	
Hard drives available	40MB, 60MB	
Numeric coprocessor	387-20SX	
Replacement battery	✓	

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the background information necessary to make an informed decision—including an extensive features table and suitability-to-task ratings—but you must begin your database search by examining your own needs and capabilities. Do you need an

COVER STORY

RELATIONAL DATABASES

application development system for computer professionals or interactive data management facilities for end users? Are you a database administrator or an end

user with some programming skills?

The following 15 evaluations will help you sort through the alternatives and select a database package to suit you today and provide a growth path to the future—a system you won't outgrow.



EDITORS' CHOICE

- *FoxPro*
- *Paradox*

As our suitability-to-task ratings show, it can be difficult to find a programmable, multitable database package that satisfies the needs of both database application developers and end users. The strongest development packages are sometimes unfriendly to end users, and the packages with the best interfaces sometimes lack powerful programming tools.

There is, however, a happy medium, and there you can find two packages.

FoxPro is recommended to anyone doing database development. Its end-user facilities do need a small nudge toward friendliness (the soon-to arrive Version 2 should help on that front), but it's an outstanding product with amazing speed—speed that is tangible proof of the hot technology behind the software. An earlier version of *FoxPro* won an Editors' Choice in *PC Magazine's* Project Database III, and the improvements have kept on coming since then. Priced at \$795, *FoxPro* is a terrific product in nearly every respect, most notably speed; it finished first in nearly every benchmark test.

Borland's *Paradox*, \$795, another previous Editors' Choice package, comes up a winner again in Version 3.5. Designed around a table-based metaphor that distinguishes it from most other databases, *Paradox* may take some getting used to, but the well-designed workspace proves both friendly and functional. *Paradox* bridges the gap between end users and application developers with a strong set of programming tools, including the full-featured *Paradox*

Application Language. Its benchmark performance, while not as stunning as that of *FoxPro*, was consistently good.

Honorable mention goes to three packages, including the \$795 *DataEase*. Though it's not a winner in terms of raw speed, any slowness in *DataEase* is more than offset by the advantages the package's ease-of-use brings to database development and maintenance.

Honorable mention also goes to Microrim's venerable *R:BASE*. The intuitive interface, outstanding Applications Generator, and links to *dBASE* make it a tough competitor. *R:BASE* 3.1, with a price tag of \$795, has a useful programming language, but its lack of tools keeps it from being a good choice for the professional programmer. Nevertheless, it's an excellent system for nonprogramming users who want to create personal or in-house applications. You can grow into this package (perhaps from Microrim's even easier-to-use *Personal R:BASE*), taking advantage of its more powerful features as your experience and needs allow.

Microsoft Windows fans don't yet have a huge variety of choices in this category, but the \$595 *Superbase 4*, which is surprisingly fast in spite of the *Windows* environment, is a thought-provoking package and the one to choose if you must have a graphically based database now, as opposed to running a text-based package as a *Windows* task. The menus and manuals need to be reworked (that's promised for the

next release), but the integration of graphics the package supports and its somewhat object-orientated design prove that there is a future for graphical databases.

For database application developers in particular, *Advanced Revelation* and *Ingres* are both capable competitors. Both packages contain powerful programmer's tools and convenient links to higher-end distributed systems. What the packages lack in end-user friendliness they make up for in development potential.

Casual and nonprogramming database users may ask whether they need a programmable, multitable database package at all. Maybe not. If you don't anticipate your database needs extending far beyond sorting mailing lists or making simple queries, any of the packages evaluated here is overkill. You may find that a good flat-file package like Borland's *Reflex*, Symantec's *Q&A*, or Buttonware's *PC-File* can satisfy all your needs. Priced from about \$125 to \$350, flat-file packages are generally cheaper than relational packages and, in most cases, much easier to learn and use.

One last important question remains: what about the market leading \$795 *dBASE IV*? It's clear that Version 1.1 is a vast improvement over Version 1.0 as well as *dBASE III Plus*, and any *dBASE* devotee who hasn't upgraded yet should. But the package is still lacking in a number of areas. There are problems with its QBE and SQL implementations, and its Control Center needs to be reworked. It could also use a boost in performance.



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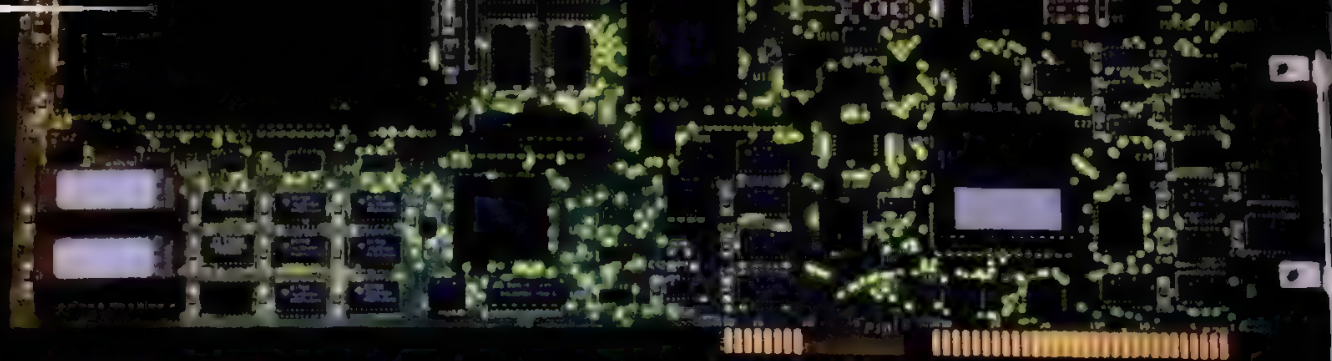
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Memory type	SIMMS	Custom	Custom
WD-1003 Emulation	Yes	Yes	Yes
Custom drivers	Optional	No	Optional
Drive types supported	IDE, SCSI, RLL, ESDI, MFM*	ESDI	ESDI, MFM, RLL
Networks, UNIX and multiuser systems	All	Most	Some
Boot drive	Any	"C" only	"C" only
1-to-1 interleave	Yes	No	No
Auto data repair	Yes	No	No
Parity check RAM	Yes	No	Yes
12.5 bus speed	Yes	Yes	Opt.
Data look ahead	Track	Sector	Sector

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* 3rd quarter 1991

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Advanced Revelation

by Joe Salemi

Don't let *Advanced Revelation* fool you. While the pull-down menu system in the \$995 Version 2.03 may resemble that of an end-user database package, this package is primarily a programmer's database. Revelation Technologies combines robust applications design tools with support for four programming languages to give you a powerful programming environment.

The *Advanced Revelation* system begins by asking you to select novice- or advanced-level menus. Essentially the same, these menus are distinguished by the amount of prompting and help you can access. The novice level, which provides a status bar at the bottom of the screen listing the actions assigned to function keys, is the better choice. The way *Advanced Revelation* uses these keys is not intuitive, but the reliable on-line help system provides general information and context-sensitive help.

WINDOWS WITHOUT WINDOWS

Even though *Advanced Revelation* is a text-based package, it is "windows" oriented—it uses the term "window" to describe what most other database packages call a form. Just about every action you can take involves opening a new window or pop-up list.

The first choice on the status-bar main menu is Design, which leads you to a series of menus that offer tools for designing windows, reports, and menus. The powerful window designer gives you complete control over the layout of prompts, fields, and window size. While designing a window, you're actually designing the database, which is the exact opposite of the way most databases work. *Advanced Revelation* creates a temporary

database that holds the field names and definitions you've created, and lets you test-run the window as you're designing it. You can use pop-up lists of possible actions and choices, such as the display format for the data or validation rules, throughout this process. Once you're satisfied with the design, you can choose to save it as the real database.

By selecting items such as Windows or Reports from the Access menu, you can



Advanced Revelation, Version 2.03
Revelation Technologies Inc., 2 Park Ave.,
New York, NY 10016; 800-262-4747, 212-689-1000.

List Price: \$995.

Requires: 640K RAM, OS/2, DOS 3.1 or later.

In Short: A powerful database development environment directed at applications programmers. The package supports four languages, including SQL commands, and provides access to ASCII and dBASE III native file formats through "environmental bonds." Modules to access SQL database servers are available at additional cost.

CIRCLE 406 ON READER SERVICE CARD

use the windows and menus you've created to manipulate the database. The choices in the Management menu give you control over the *Advanced Revelation* system itself, including the start-up menus and user accounts. Select SQL from the main menu to open a window where you can type in interactive SQL (Structured Query Language) commands to query the database.

The Tools menu helps you maintain the databases themselves. The most important function here is the creation of indexes for the data. *Advanced Revelation* supports three different types of indexes: B-tree, Cross-reference, and Relational. Your selection depends on a number of factors, including the size and type of data with which you're working. You can apply any or all of the three indexes to a single database.

PROGRAMMING LANGUAGES

SQL is one of four programming languages supported by *Advanced Revelation*. The primary language, R/BASIC, is complex and has a wide range of functions for manipulating the data and the database environment, including a variety of debugging routines and tools. After you write an R/BASIC module, the system precompiles the module for speed and security. You can design reports directly by programming in R/LIST (the report writer language), or indirectly by using the *EasyWriter* report generator, which creates R/LIST routines from your design.

TCL (The Command Language) is the master control language for the entire *Advanced Revelation* system, based on a combination of command-line and job-control languages. TCL routines control the overall execution of applications by displaying windows and calling the appropriate R/LIST and R/BASIC modules. You can access the TCL command-line window from any point in the program by pressing the F5 key.

Advanced Revelation placed toward the back of the pack on PC Magazine Labs' tests, though a performance gain was seen when proper indexing was in place. Tests involving indexed data were completed in seconds in most cases, regardless of the amount of data. Tests based on unindexed data took minutes, and in the case of the 100,000-record Project Test, 2 hours and 40 minutes to complete (tenth out of the 13 packages that completed the test). Given a choice of three indexing methods (each of which has advantages, depending on the type of data you're storing), you should test your applications to be sure you're using the right one for the best performance.

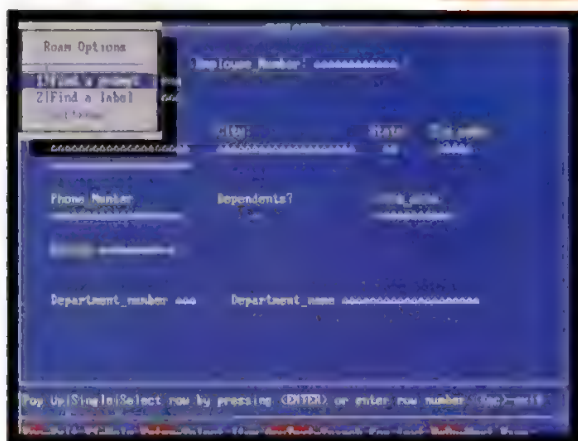
ENVIRONMENTAL BONDING

Advanced Revelation has a feature that is not found in many database packages: the ability to store multiple values for a field in the same record. This can decrease storage requirements by cutting down on the amount of duplicate data in the database, while reducing the search and retrieval time. The program's security features are also very tight and easy to set up. Through "Environmental Bonding," a feature new to Version 2.03, you can incorporate into the *Advanced Revelation* environment option modules which let you access other databases' data files in their native formats. Environmental Bond-

SUITABILITY TO TASK

Advanced Revelation

Data loading and access	☒	☒	☒	☒
On-line inquiry	☒	☒	☐	☐
Ad hoc reporting	☒	☒	☒	☐
Professional applications development	☒	☒	☒	☒
End-user applications development	☒	☒	☐	☐



Pop-up menus provide assistance in designing *Advanced Revelation* data-entry windows; the friendly interface does not steal from the package's programming power.

ing lets you do this through standard *Advanced Revelation* languages and windows. Environmental bonds for ASCII and *dBASE III* files are included; bonds for SQL database servers are available for an additional \$695.

Although Revelation Technologies has indeed made progress in improving the user interface, *Advanced Revelation* is too complex for occasional use. Nonprogrammers may find the system of overlapping windows confusing. And unlike the *R:BASE* approach that leads users through a series of easy steps, the process of designing and building a database and generating applications does not include a guided tour.

Advanced Revelation is a powerful database development environment geared toward programmers. While many other systems are better suited to the needs of nonprogrammers and casual users, *Advanced Revelation* is an excellent choice for those who design databases professionally.

Clarion Professional Developer

by Richard Hale Shaw

Today's database packages rarely encourage casual applications development for end users. Clarion Software's *Clarion Professional Developer*, Version 2.1, is an exception: Casual developers with a bit of database savvy will find the \$845 pack-

age a powerful, professional-quality database development system that they can master.

Professional developers won't be surprised at the features *Clarion* packs: Designer, a powerful application-generation tool; a Report Writer that operates via simple menu selections; a robust database language; and tools that create, edit, and compile program code as

well as view and modify database files. These tools are provided as separate executable programs, rather than components of a single program and interface, which you can run from the DOS prompt or from a single menu.

NO-CODE APPLICATIONS

With *Clarion*'s Designer, you don't have to write any code to create an application. You can use Designer to paint screens, prompts, and fields, and combine them all with procedures and reports that you define. Designer then generates the source

SUITABILITY TO TASK

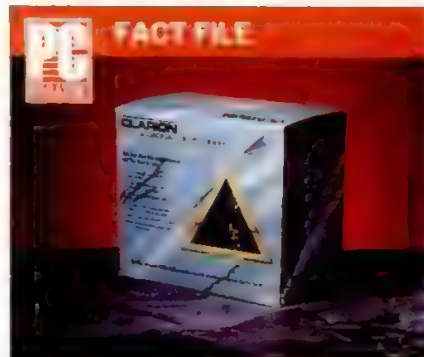
Clarion Professional Developer

Data loading and access	☒	☐	☐	☐
On-line Inquiry	☒	☒	☐	☐
Ad hoc reporting	☒	☒	☐	☐
Professional applications development	☒	☒	☒	☒
End-user applications development	☒	☒	☒	☐

code for the application. You can supplement or modify the code if necessary, or compile it into a standalone executable application.

Designer lets you create a complete application including a menu for each procedure, database tables, and forms to update them. If you specify, Designer will also generate multiuser file-locking code for networking applications. You can use the source code generated by Designer to create an applications framework and add record-locking and data-security com-

mands via the *Clarion* programming language. Designer will also let you protect or encrypt the individual files included in the application.



Clarion Professional Developer, Version 2.1

Clarion Software, 150 E. Sample Rd., Pompano Beach, FL 33064; 305-785-4555. List Price: \$845.

Requires: 512K RAM, DOS 2.0 or later.
In Short: A database for professional and casual developers. The ability to create standalone executable programs as well as applications makes this package especially good for casual developers. Not recommended for end users.

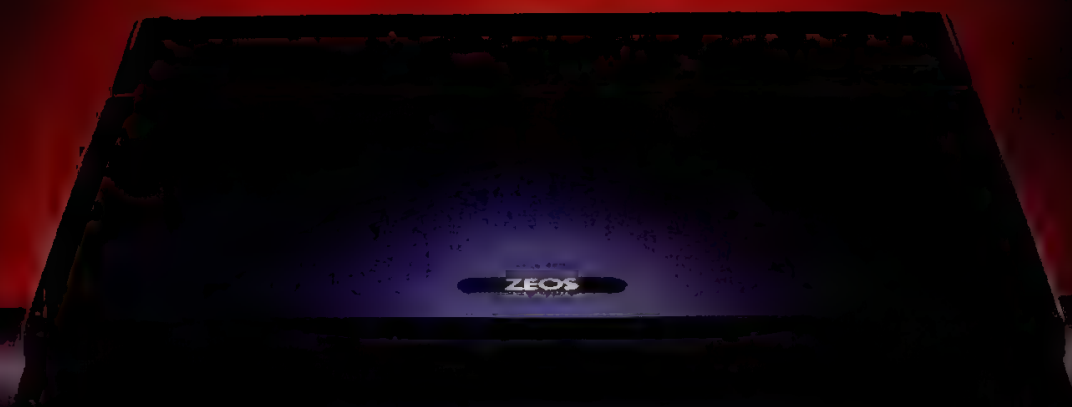
CIRCLE 408 ON READER SERVICE CARD

Designer's Quick Start feature offers casual developers the same functionality as *Clarion*'s \$199 *Personal Developer*. It lets end users define the applications, although it's limited to ten fields per database. This lowers the training threshold for end-user development and lets sophisticated users deliver relatively ambitious applications.

ROYALTY-FREE DISTRIBUTION

One of *Clarion*'s more powerful features is its ability to compile programs into standalone .EXEs (executable programs) that you can run from the DOS prompt and distribute on a royalty-free basis. While Ashton-Tate (maker of *dBASE IV*) and other major database developers have promised this mechanism to their own users for years, Clarion Software has been offering it all along. This feature is facilitated by the addition of Pocket Soft's *RTLink*, which lets you create overlaid programs that allow large applications to run in limited memory. *RTLink* also makes use of runtime libraries—similar to the *Microsoft Windows* Dynamic Link Libraries (DLLs)—that are single files containing code common to and shared by several different applications.

With *Clarion*'s Ad Hoc Report Writer, you can create complex, formatted re-



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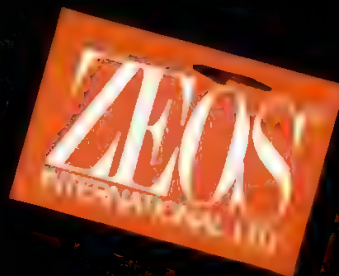
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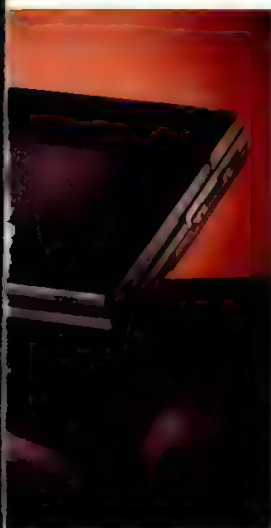
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 **VIDEO:** ZEOS raises the ante to VGA! We're talking about bright and crisp VGA displayed on one of the largest notebook screens in the industry. The display also features advanced fluorescent backlighting, 32 grey scales and 640 x 480 resolution. Plus, it can be adjusted to any position over a 135° angle and features easily adjustable brightness and contrast controls. Easy viewing under virtually any lighting conditions. You can connect to an external VGA color monitor too!

 **GREAT BATTERY FEATURES:** Every battery feature you want. You can plug your notebook in and "quick charge" the battery in less than one hour or you can "trickle charge" while in use. Plus, your battery easily snaps out allowing the quick installation of an optional replacement battery. It's great to be able to carry a light weight spare for those especially long trips. An optional battery charger stand is available as well.

 **INTELLIGENT POWER MANAGEMENT:** Your new ZEOS notebook features an intelligent programmable power management system if you wish to use it. Based on the length of time since your last keystroke, you may reduce CPU speed, display screen backlighting etc. Full power is immediately restored at the stroke of any key. The system even knows *not* to use the power management system when you are operating on AC power!

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which may be programmed to inform you of a low battery condition and to let you know if the cover is closed with the power on. Now that's one smart notebook!

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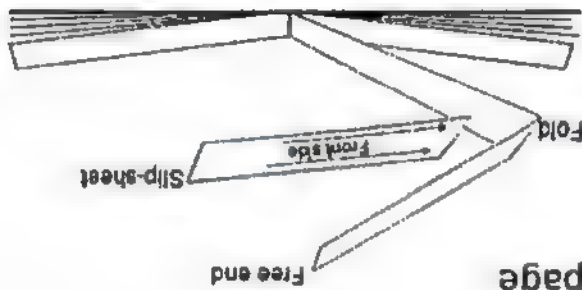
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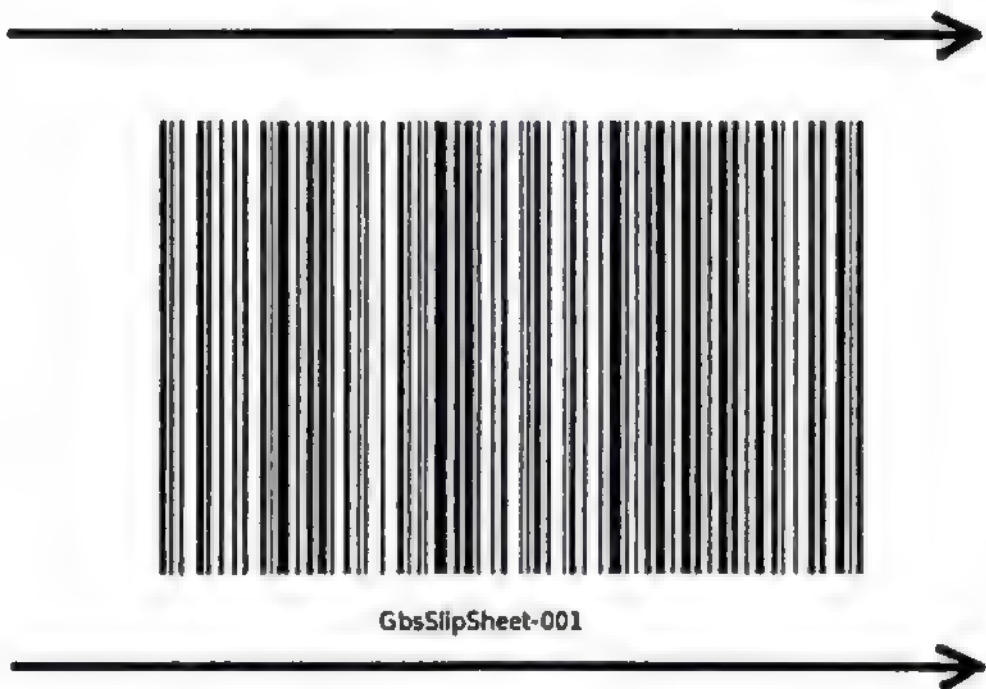
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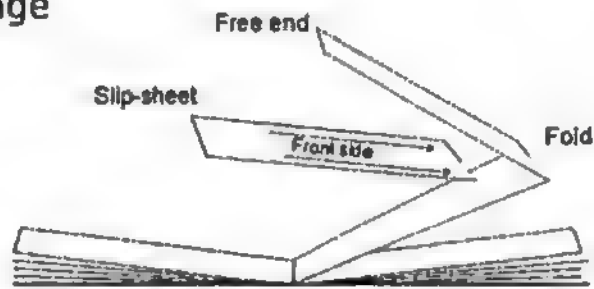
Inverted Foldout slip-sheet



Folded edge of the page

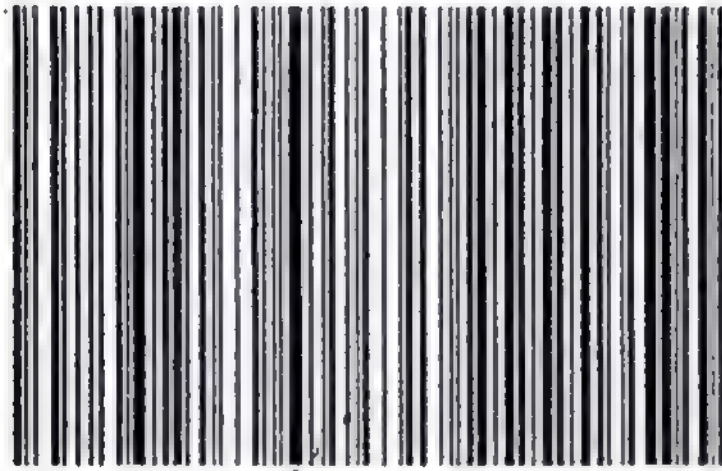
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1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

1. Follow instructions on the other side

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Two drives are better than one! First, your notebook will include our whisper quiet high speed, high capacity hard disk. It will read and write your data so fast chances are you'll hardly know it's there. Then we're building in an industry standard 1.44 Megabyte 3.5 inch floppy as well.

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10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but seven times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editor's Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

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Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent."



Value: Excellent."

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Reason #6

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Reason #7

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Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

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ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, Discover, American Express, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

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A married person may apply for individual credit. I am applying for (please check appropriate box):

☐ **JOINT CREDIT** with another person. Complete entire application.

☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.

☐ **INDIVIDUAL CREDIT.** Do not complete Section C.**

**If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

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☐ married ☐ unmarried ☐ legally separated

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Name _____

Home Phone (_____) _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____

City _____ State _____ Zip _____

Employer _____ Since? (Mo./Yr.) _____

Monthly Gross Salary \$ _____ Daytime Bus. Phone (_____) _____

Previous Employer _____ From - To _____

Occupation _____

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income \$ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE: Checking Account ☐ Yes ☐ No
Savings Account ☐ Yes ☐ No

	Y/N	How Many?	Y/N	How Many?
Bank Loan	_____	_____	Dept. Store Charge Card	_____
VISA	_____	_____	Credit Union Account	_____
MasterCard	_____	_____	Other Major Charge Cards	_____
Finance Company Loan	_____	_____		

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (_____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

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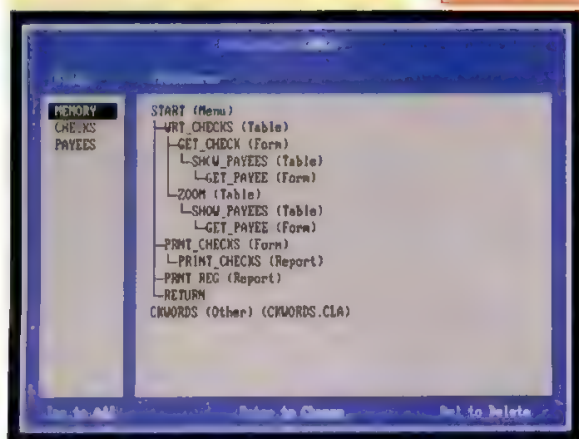
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Clarion's Application Designer offers a module-browsing facility that shows you the relationship between each of the procedures and functions in your application.

ports from simple menu selections without writing a single line of code. Positioning fields in a report is easy with a pop-up window displaying field names to choose from. The Report Writer is easy enough for end users to produce their own reports. (The Report Writer is available separately for \$199.) The package includes a runtime report utility so developers can distribute report applications without having to purchase multiple copies of the Report Writer.

Additional features include a RunSmall procedure that executes minimal-memory tasks, such as the DOS DIR command, without taking the time to swap the entire current execution environment out to disk. You can use the Shutdown function to specify a procedure to call whenever your program terminates, whether you press Ctrl-Break or a runtime error occurs. Like *Paradox* and *dBASE*, *Clarion* offers an autorefresh facility so data displayed on your screen will be updated if its associated records are changed in the database by another user.

In addition to the manuals included in the package, *Clarion* has an on-line tutorial that guides newcomers through each of the utilities, the language structure, and the development environment.

COMPULSIVE CHECKING

While *Clarion*'s performance is not bad, it could be improved. *Clarion* did show evidence of a strong query optimizer in the Join tests, but otherwise, the package's times were average or below aver-

age, reflecting the system's less-than-optimal method for adding, deleting, and updating records. Before the user or an application can make changes to a table, *Clarion* checks the time stamp in the file header to insure that the file hasn't changed since the application began using it. Thus, during a global search-and-replace,

Clarion checks this header with every change—an expensive, time-consuming operation.

Some *Clarion* features are atypical of most PC database management systems. For instance, *Clarion*'s OPT attribute on a field prevents the entry of 'NULL' values, which it defines as zero values in numeric fields or blank values in character fields. In relational database circles, however, a 'NULL' value normally prevents empty or undefined field values from being en-

Some Clarion features are atypical of most PC database management systems.

tered. Using a zero quantity can be a valid and useful designation, such as in an inventory application to show that a part is out-of-stock. You may find *Clarion*'s untraditional use of the term 'NULL' disconcerting.

The *Clarion* interface—a plethora of distracting program tools and menus—needs better integration through the use of a windowing, CUA-compatible interface. Finally, *Clarion* makes an odd distinction between dynamic and static index keys. Static indexes are not updated when you change the database and are designed for use with infrequently run tasks such as producing reports. But dynamic keys cannot be dropped or deleted. In this case, the approach of other databases that give you the flexibility of determining when to up-

date indexes and allow you to rebuild them as necessary is preferable.

Casual developers will find *Clarion* a productive database package. If you're not a professional developer, but are looking for the tools to perform like one, check out *Clarion Professional Developer*.

Condor3

by Henry Fersko-Weiss

Condor DBMS Services released the first version of its *Condor3* program back in 1977 under the name *Database Management System*. It was the first relational database package for personal computers, and in recognition of this, a copy now resides in the Smithsonian Institution. The original roots of the package are still visible in the current \$395 *Condor3*. While there is a menu structure, you work primarily at the command-line level. *Condor3*'s command language is very simple to learn and doesn't require you to write countless lines of code to perform most operations.

You set up a file, add or change data in a file, and do multiple file processing from the Main Menu. When you follow any of these menu paths beyond the second level, you run right into the command line. There, *Condor3* enters the appropriate command for you, but you must type in the rest of the command; the system displays the command pattern at the top of the screen.

In a sense, the menus are a learning tool for the command language. If you bypass the menus and work at the command level, you don't have the safety net of the command example, but you do have more direct control. To perform a series of operations, you can record them as you would a macro and replay the recorded commands.

SUITABILITY TO TASK

Condor3

Data loading and access	☒	☒	☐	☐
On-line inquiry	☒	☒	☐	☐
Ad hoc reporting	☒	☐	☐	☐
Professional applications development	☒	☒	☐	☐
End-user applications development	☒	☐	☐	☐

PostScript solutions for LaserJet printers haven't exactly set records for speed.

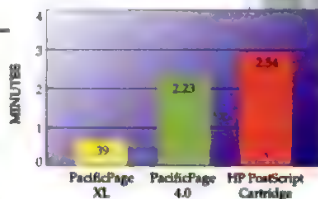
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DESIGNING SCREENS

To create a data file in *Condor3*, you type field names anywhere on a blank page. To set the field length, you type the correct number of underlines after the field name. When the layout is complete, *Condor3* prompts you to define the field types. You might type an A for an alphabetic field or N.n for a decimal-numeric field. The system fills in the size of the field you specified, as well as its minimum and maximum values. If necessary, you can change the default value range.

Condor3 offers you a very limited number of field types: alphabetic, alphanumeric, two types of numeric, dollar, and date. The date field has a two-digit year format, making the maximum date 12/31/99, unless you use programming to get around it.

After you define a data file, entering data is simply a matter of typing ENTER and the filename. To change information in a file you use the UPDATE command, and to select records you use the SELECT command. For instance, to make the program update all the Invoice file records for the state of New York, you type: UPDATE INVOICE WHERE STATE IS NY. This command is so close to plain English that you quickly start to feel like an experienced user.

Commands are also brief, so with just a few words—no strange syntax or complicated statement structure—you can perform far-reaching operations. This simplicity makes projecting and joining data files much easier than in many other packages.

When *Condor3* joins files, the fields are placed end to end, starting in the upper-left corner, so you'll have to rearrange the fields if you want the records to look good.

The tricky part of reformatting is making sure you enter the correct number of underlines to represent the field length. Also, if you put a field too close to the right-hand side of the page, the data will not wrap to the next line, and your data may get truncated.

In addition to typing commands at the command level, you can run a series of commands using a .CMD command file, which makes it easy to automate complex program sequences that you run fre-

quently. You can also chain command files together, calling one from another. Using the command file feature, you can replace the *Condor3* Main Menu with one you create.

On the PC Magazine Labs tests, *Condor3* was one of the packages that could not complete the 100,000-record testing within our time limits. In 10,000-record testing, the package proved to be of average speed. But on the Record test it tied for first place with *DataEase*.

STRUCTURING QUERIES

You use the List, Display, and Select commands to query data files in *Condor3*. The Display command shows you complete record forms. List lets you select fields from records and presents the results in a columnar format. With the Select command, you can identify records for a report and extract information from records.

The main components of the query commands are the WHERE and BY phrases using the connectors AND and OR with comparison verbs, such as equal or less than. These command statements can be only 127 characters long, so complex searches force you to do successive selects or use a command file.

After you design a report layout much as you do with the data entry form, *Condor3*'s report writer lets you finish the report using a short or long method. The

**Condor3**

Condor DBMS Services Inc., 5209 North Clark St., Chicago, IL 60640; 312-271-8759.
List Price: \$395.

Requires: 336K RAM, DOS 2.1 or later.

In Short: *Condor3* operates most efficiently from the command level; its menus are nothing more than an introduction to the commands. However, the program language is simple to learn. You can design complex applications, but the package is limited to 65,000 records per file and has an awkward report writer.

CIRCLE 410 ON READER SERVICE CARD

short method is tedious because it requires information about the printing of each line. The long form is even worse because you have to tell the program about each item in a line. On the positive side, *Condor3*'s report writer lets you create almost any report form you can imagine, although styling elements are not available.

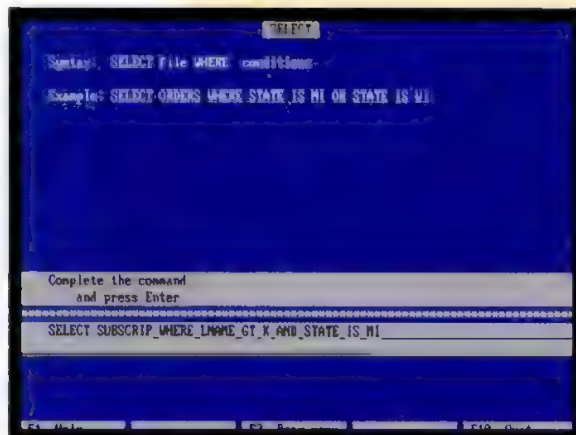
Condor3 falls somewhere in between high-end programmable databases and flat-file packages. While it's hampered by a 65,000-record limit and the report writer is awkward to use, it's an easy-to-learn database package with a capable command language.

DataEase

by Alfred Poor

Most people equate database power with inscrutable complexity, and ease of use with wimpy and limited capabilities. DataEase International provides the exception to the rule with *DataEase*, Version 4.2, a \$795 powerhouse.

DataEase relies heavily on menus and prompted data-entry screens for its interface. The program itself is built using tools similar to those you use in developing *DataEase* applications. Like other database programs, you can build a sequence of commands to be executed, but for the most part, *DataEase* takes a more nonpro-



When you drop past the second level of menus in *Condor3*, you reach the command level. At that point you enter commands following the example and syntax rule shown at the top of the screen.

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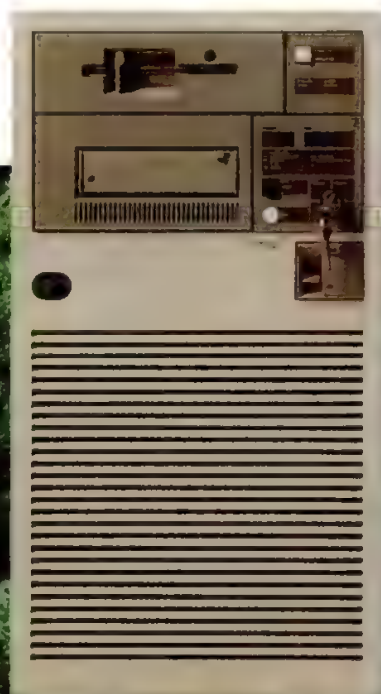
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cedural approach through which you define operations by designing screens and filling in blanks.

KEEP YOUR DATA IN GOOD FORM

The fundamental element of a *DataEase* application is the form, which serves the dual role of data table structure and data-entry form. You create a form by painting headings and fields on-screen. A function key opens a field definition screen, and

SUITABILITY TO TASK

DataEase

Data loading and access	☒	☒	☒	☒
On-line inquiry	☒	☒	☒	☒
Ad hoc reporting	☒	☒	☒	☒
Professional applications development	☒	☒	☒	☒
End-user applications development	☒	☒	☒	☒

the name of the field defaults to the text immediately adjacent to it. Type "Name," press F10, and you are ready to define a field called "Name." After you define field type, length, and so forth, you record those settings. The system then returns you to the screen, with your newly defined field appearing as a block.

DataEase relies heavily on field-definition features for its wide range of complex data-entry validation and edit-mask functions that other packages require custom code to accomplish. There are the typical must-fill, unique value, and calculated field functions, but you also get to define permissible value ranges, formatted numeric strings (including phone, social security, and custom formats), and security levels to control read and write access and prevent data entry.

You can also specify automatic sequential numbering of records to make certain that a number is never used twice. Other field definition features let you look up corresponding values in a related table, bring back related fields, or simply verify that the value entered exists in another table.

DataEase has a handy feature called a multiform screen, which displays the contents of two or more forms on a single screen. First you define the parent form, then a subform that displays related data

from another form. You then set the minimum and maximum number of lines to appear in the subform, and its size will grow or shrink as required by the total number of matching records. You can enter, edit, and delete records in the subform just as you would on a regular form. To construct this in a typical package like *dBASE* or *R:BASE* would take hours of programming and pages of code. With *DataEase*, it takes only minutes to paint the screen and fill in the forms.

The multiform feature is the only area of *DataEase* that offers automatic referential integrity checking, but this is still more than what the other packages offer in this class. You can even specify what actions you want the program to permit or prohibit. For example, you can set it to prohibit deletion of a parent record if there are related child records. On the other hand, you can set it so changes to the parent cascade through the children—a feature that makes it a snap to update all related records at one time.



DataEase, Version 4.2

DataEase International Inc., 7 Cambridge Dr., Trumbull, CT 06611; 800-243-5123, 203-374-8000.

List Price: \$795; Workstation 3-pack, \$795;

Workstation 5-pack, \$1,095; *DataEase*

Developer (unlimited runtime license), \$795.

Requires: 640K RAM, DOS 3.1 or later.

In Short: Whether you are a novice or an expert in a single or multiuser setting, *DataEase* promises to help you create sophisticated database systems with minimum effort and time. Few packages come close in terms of the combined power and ease offered by this package.

CIRCLE 411 ON READER SERVICE CARD



In *DataEase*, relationships among tables are defined simply by filling in the blanks on a form and listing which two (or more) are to be matched. You also define referential integrity controls for *DataEase*'s multitable screens here.

QUICK QBE REPORTS

DataEase's form-based approach make other functions equally easy to use. Relationships between forms are defined on a form. You can base the matching on one or more fields, and while it may be slower, you can even define relationships based on nonindexed fields. User security levels, printer support, data import functions, and custom menu definition are all accomplished by filling in forms.

You can even create sophisticated reports without creating a procedure. *DataEase*'s QBE "Quick Reports" are defined by filling in a series of forms for record and field selection. You can even hotkey to a related form and specify fields there.

DataEase can automatically set your report in columnar format with group headers and footers or use the same layout as your form. If you prefer, you can build your own layout from scratch or from one of the automatic layouts. It took me about 3 minutes to build a departmental telephone directory using the simple personnel database used in our referential testing. You can define your output destination as the screen, printer, or file, or you can make the selection each time you run the report.

PROGRAMMING POWER

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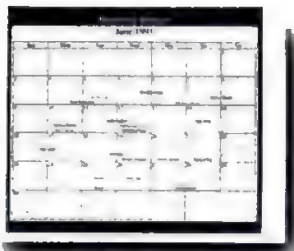


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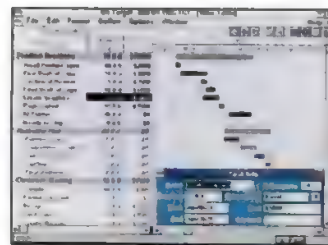
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COVER STORY RELATIONAL DATABASES

need to use the DataEase Query Language (DQL), which allows you to report, update, batch delete, and automate manipulation of your data. There are three modes you can use. The low-level prompted mode guides you through the assembly of command sequences by prompting you with the most commonly used commands. Since all your choices are on-screen at one time, you never waste time looking up field names or command options.

The high-level mode works in the same manner, but it presents all options, giving you more access to more-powerful commands. Finally, there is the full-screen edit mode in which you can move around the screen freely, typing in commands as you go. *DataEase* automatically checks your code for correct syntax before storing it. While this is convenient, you have to comment out problem areas that need more debugging before you can save a work in progress.

In terms of performance, *DataEase* was not one of the fastest packages tested, but its lack of speed shouldn't scare you away. On the 100,000-record test, it actually showed some of the fastest times (except when loading and indexing), so it is worth consideration if you develop extra-large applications.

When you consider the time saved in developing and maintaining a complex database system with *DataEase*, the daily performance differences are not likely to be a significant factor.

There are some other features worth noting. For example, one version of *DataEase* works on single-user and network installations so you don't need to code any special multiuser locks. *DataEase* handles that automatically, including automatic screen updates, if you choose. There is also a separate version of the package that makes use of extended memory.

In January 1991, DataEase International released *DataEase SQL Network Edition 1.01* (\$1,995) and *DataEase SQL Professional* (\$995), which provide connectivity to *Sybase/Microsoft SQL Server*, Version 1.1, and provide a single install of DOS and OS/2 workstation software support. Development of versions to work with *Oracle Server* and *IBM's OS/2 Extended Edition Database Manager* is now under way.

There are a few weaknesses that were found in earlier versions, but most have been solved in this release. For example,

it is too easy to inadvertently add a new duplicate record instead of updating an existing one, but you can avoid this by defining a unique field on the form. Another welcome change is an option to clear the screen after entering a new record. The way of querying related fields in one-to-many or many-to-one DQL procedures can be confusing, making it difficult to get the desired results. Fortunately, revisions are fast to test, so you can get your code debugged quickly.

DataEase does live up to its considerable reputation for providing powerful features in an accessible package. Whether you are a novice looking for a database package you can grow into or a developer who wants to shorten the time spent creating custom applications, *DataEase* deserves a place among your finalists.

● dBASE IV by Richard Hale Shaw

Only one personal computer database is nearly a household word: Ashton-Tate's *dBASE*. Since last year's arrival of *dBASE IV*, Version 1.1, *dBASE III Plus* users have been able to upgrade safely. Now, what does the \$795 package offer above and beyond the other databases evaluated here?

dBASE IV is almost completely managed by the Control Center, an interface tool that lets you pick and choose from database objects like tables, views, forms, reports, label designs, and even programs. The Control Center lets you easily switch from one module to another without wading through layers of menus as you would in *Clarion*, but it doesn't offer the ability to view files in multiple, overlap-



dBASE IV, Version 1.1

Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90509; 213-329-9989.

List Price: Standard Edition, \$795;

Developer's Edition, \$1,295.

Requires: 640K RAM, DOS 2.1 or later.

In Short: A powerful end-user database with a handful of features aimed at developers. Although this is Ashton-Tate's best version yet, and all *dBASE* users who haven't yet upgraded should, developers of *dBASE*-compatible database applications should look elsewhere for better development tools.

CIRCLE 412 ON READER SERVICE CARD

ping windows as *FoxPro* does, or even view query results while operating the main menu as *Paradox* does. The interface cries out for mouse support as well. The Label and Report Generators offer WYSIWYG interfaces for designing labels and reports. If you prefer the old *dBASE* dot prompt, you can drop out of the Control Center at any time.

END-USER ATTRACTIONS

dBASE IV offers a number of features that make it attractive to end users, particularly those users familiar with previous versions of the package. For instance, the query-by-example (QBE) module is integrated into the Control Center and lets you search for sets of records by checking off the fields you want to see in a QBE form. You can establish selection conditions by entering simple expressions and formulas in a condition box and retrieve the corresponding rows with a few keystrokes. QBE will dynamically expand the form's field widths as you type in expressions and let you use aliases for the names of output fields in the results. With the ability to perform calculations, multitable joins, summaries, and sorts, *dBASE IV*'s QBE will also let you execute partial and approximate searches.

Unfortunately, there are more than a few problems with the way *dBASE IV*'s QBE is implemented. For instance, the QBE module doesn't actually perform a search. Instead, it generates a *dBASE* language program that uses the SET FIL-

SUITABILITY TO TASK

dBASE IV

Data loading and access	☒	☒	☒	☒
On-line inquiry	☒	☒	☒	☒
Ad hoc reporting	☒	☒	☒	☒
Professional applications development	☒	☒	☒	☒
End-user applications development	☒	☒	☒	☒

TER TO and SET RELATION TO commands to establish the search conditions for retrieving the records and invokes *dBASE* to run this program. While this lets you reuse queries generated with QBE, there's no opportunity for dynamic query optimization—as in *Paradox*—to take advantage of changes to the relationship between the desired records and the rest of the database.

Further, *dBASE* creates a view of the requested records, and if you BROWSE query results derived from multiple tables, the results are read-only and you cannot modify them. Finally, *dBASE* insists that an index be available that matches the record search criteria. If you don't create the index, *dBASE IV* will create one when you save the query, a process that consumes both time and disk space. This is annoying when you're creating but not

executing a query. It's a crippling problem when you want to run ad hoc queries against a large database.

On our benchmark tests, *dBASE*'s results ranged from second best in Output Overhead (because of their disk cache) and the top three for Selecting to slowest overall in some parts of the 100,000-record Join test. In loading, indexing, projecting, and reporting, *dBASE*'s results were average.

SQL IMPLEMENTATION

Like QBE, the Report Generator creates a *dBASE* program that you can run to produce reports. It will let you construct groups on all 'n' records, create breaks on field contents, and access multiply related database files. *dBASE IV*'s SQL

implementation offers set-oriented access to *dBASE* data files and uses *dBASE* files to implement a DB2-style system catalog. Unfortunately, SQL cannot execute as quickly as *dBASE* commands, since every SQL command has to be converted to *dBASE* first. Plus, it's easy to mix up *dBASE* and SQL commands that have the same name: DELETE and SELECT have different meanings in the two languages.

Developers will find that *dBASE IV*'s most powerful features include user-defined functions (UDFs), commands to manipulate screen images, and conditional indexes. With UDFs, you can create your own functions and extensions to the *dBASE* language. You can use UDFs anywhere the system accepts a valid *dBASE* expression: in QBE, applications, calculated fields, and as arguments to commands or functions. This last use of UDFs is an

NO COPYRIGHT, BUT NO COPYING

by Winn L. Rosch

Bombshells never strike lightly, and the intensity of their blasts is rarely expected. From a simple two-page order issued by United States District Judge Terry J. Hatter, Jr., on December 11, 1990, the reverberations echoed through the database industry as if there had been a nuclear strike.

"The Court finds that Ashton-Tate, when it filed its original application for copyright, repeatedly failed to disclose material information to the United States Copyright Office," says the order. "The Court, therefore, finds that Ashton-Tate's copyrights on its *dBASE* line of computer software programs are invalid as a result of inequitable conduct."

The tough language represents the climax of a case that began on November 18, 1988, when Ashton-Tate filed a lawsuit against Fox Software and the Santa Cruz Operation for copyright infringement and unfair competition.

Ashton-Tate claimed that Fox Software's *FoxBase* was copied from its *dBASE* product line. Fox stressed several defenses, perhaps the strongest being that Ashton-Tate had cooperated in (and even encouraged) the development of *FoxBase* and thus implicitly approved of the product.

The Fox motion was for a summary

judgment, filed before the case went to trial, on another issue. Fox alleged that the *dBASE* family was derived from the public domain mainframe program called Jet Propulsion Laboratory Data Management and Information Systems—a fact that Ashton-Tate did not disclose to the Copyright Office until after Fox had gone ahead and filed its motion.

In summary judgment, the Court examined all the paperwork involved with the case—motions, affidavits, depositions, and other documents—to determine whether the opposing party, Ashton-Tate, could win the suit even if the law and evidence were observed in its favor. Basically, the summary judgment philosophy is that there's no point in holding a trial if the opposing party can't possibly win.

THE REAL WINNER

Ashton-Tate and Fox differ somewhat on the decision. Fox claims that it's won; the war is over and Ashton-Tate will now have to compete on the quality of its product rather than relying on copyright laws to stifle competition. Ashton-Tate plans to appeal the decision, claiming that the judge did not understand the copyright law and had applied patent law concepts instead. Ashton-Tate feels that his decision is

wrong and should be reversed.

Although the pivotal issue in this case has been decided, the lawsuit is not over. Sorting through subsidiary issues and the consideration of appeals will drag on for years. The decision could be reversed, or Ashton-Tate may be forced to pay millions to Fox on the basis of counterclaims that Ashton-Tate engaged in unfair business practices.

For now, however, the important matter is that Ashton-Tate's copyrights have been declared invalid. But as far-reaching as that decision may be, it doesn't mean that you can freely copy the latest version of *dBASE IV* as if it were public domain software. Even Fox Software agrees with that. The *dBASE* family of products remains protected by trademark law and software licenses, and the *dBASE* manuals remain protected by copyright.

But the decision is good news for you and database publishers in that it bleaches away the shadows that have hung over the *dBASE* language and file structure. No longer must the *dBASE* community worry about their freedom to use what is undoubtedly the most popular database language in the world. It gives database developers an open standard to follow without fear of future lawsuits. ■

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back to the office. Because the office is always with you.

But just in case there's something



Our user-installed memory card allows you to add up to 8 MB of memory yourself.

back at the office you still need, you can get back to it with our optional built-in modem. Which supports industry standard error corrections (CCITT V.42, V.42bis, MNP® 5). It even supports cellular data communications via our optional smart cable adapter.

The T2000SX also has a unique feature you won't find on any other computer in the world. It is called AutoResume.

AutoResume: Think of it as a bookmark for your computer.

AutoResume automatically saves whatever you're working on whenever you turn the computer off. And it lets you go directly to the program you were using last when you're ready to start up again. So you don't have to reboot, restart your application and reload your files.

AutoResume



The T2000SX has an optional modem that allows data communications via a cellular phone.

also helps save on battery life and it allows you to change batteries without losing an ounce of information.

As for batteries, the T2000SX

touts the latest in battery technology—Nickel Hydride. Nickel Hydride delivers 22% more watt-hours per pound than NiCad and it doesn't suffer from memory effect.

In keeping with the Toshiba tradition, the T2000SX also offers superior ergonomics. Like full-size, standard-spaced keys on a keyboard which has a full set of 12 dedicated function and 8 cursor control keys. And a VGA compatible, reversible black on white or white on black high resolution display.

Okay, let's wrap this thing up.

These are just a few of the reasons why we believe the T2000SX is the most useful, and therefore, most powerful computer in the world. And why PC Week® Labs said, "the T2000SX offers performance comparable to the LTE 386s/20, plus many of the design features that have made Toshiba a market leader in portable PCs."

PC WEEK

We invite you to learn more about the T2000SX and Toshiba's best-selling line of portable computers by calling us at 1-800-457-7777 for a complete information kit.

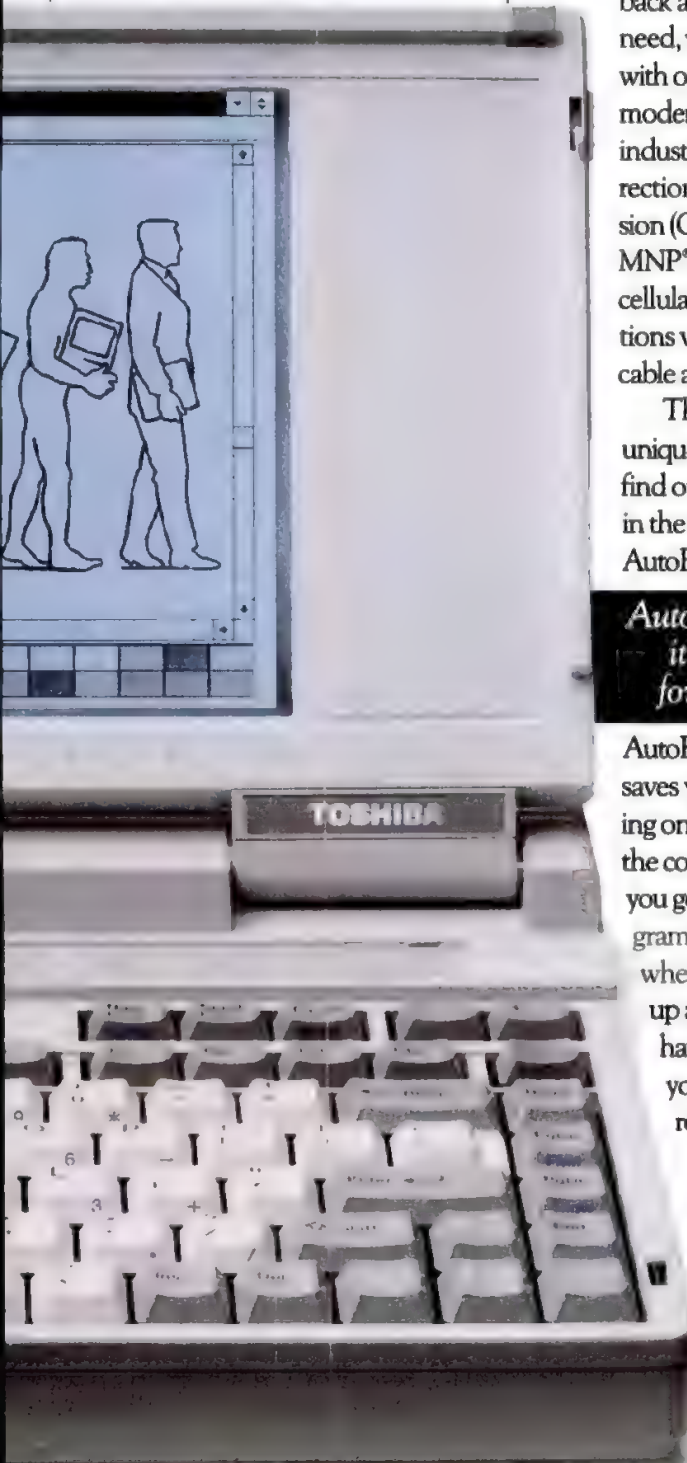
In closing, we'd like to thank you for reading our ad.

We'd also like to thank our friends at Apple for giving us such a wonderful endorsement.

In Touch with Tomorrow
TOSHIBA



The T2000SX comes complete with Hypertext on-line documentation.



COVER STORY RELATIONAL DATABASES



dBASE IV's interface uses pull-down menus to let you move from one section of the program to another. Here, the QBE screen lets you create queries by selecting fields and establishing control conditions, which can be stored and used again from an application.

innovative facility that even *FoxPro* doesn't offer.

In addition, you can use any *dBASE* command or function in a UDF definition or in SQL mode, and even write recursively called UDFs. With *dBASE IV's* conditional indexes, you can create an index that contains only keys for records that meet the FOR condition, thus creating a subset of the table's records and eliminating application search loops.

dBASE IV also offers automatic multi-user support, with both file- and record-locking and an autoretry facility for unlocking locked records. Real-time screen refreshes are available via the autorefresh facility. And *dBASE IV's* multiple indexes use a single disk file to maintain up to 47 different index keys, which are automatically opened and updated along with the corresponding database file.

Despite these innovations, most of *dBASE IV's* features merely put it on par with other databases. It's certainly not as easy to use as *Paradox* or as powerful as *FoxPro*. Although it operates in only 450K RAM, *dBASE IV* doesn't yet take advantage of expanded or extended memory. It does come with a customized version of HyperWare's *HyperDisk*, a public domain disk-caching program, which can itself reside outside of conventional memory. Although *HyperDisk* improves *dBASE IV's* performance considerably, you'll probably be better off disabling it

and using a third-party cache utility like MultiSoft's well-known *Super PC-Kwik*. What *dBASE IV* really needs is an intelligent memory manager like *Paradox's* VROOMM or the memory management technology found in *FoxPro*.

The bottom line is that while *dBASE IV* has certainly caught up with the pack, there's no clear indication where it is leading us. In our comprehensive evaluation of *dBASE IV*, Version 1.1 (*PC Magazine*, January 29, 1991), we said that the rebirth of *dBASE IV* means more competition and a promise to drive competitors to produce better database products for everyone, and everyone who wants to stick with *dBASE* should upgrade. What's desperately needed now are more and faster innovations like the few mentioned above. Another two- or even one-year hiatus before the next version of *dBASE* will be unacceptable to the marketplace. So if you can't wait, check out *FoxPro* or one of the other databases evaluated here. You won't be disappointed.

filePro Plus by Henry Fersko-Weiss

filePro Plus from The Small Computer Co. offers the best of both worlds: This \$699 package has a menu system for basic operations and a built-in processing language. The language resembles BASIC, so it's not too difficult to learn and it lets you add power and flexibility. *filePro's* limit of one billion records per file pro-



filePro Plus

The Small Computer Co. Inc., 41 Saw Mill River Rd., Hawthorne, NY 10532; 800-847-4740, 914-769-3160.

List Price: \$699.

Requires: 512K RAM, DOS 2.0 or later.

In Short: *filePro Plus* has a menu system that lets you perform a great many operations without resorting to programming. However, if you use its BASIC-style language you can create very complex applications. The program lets you maintain one billion records in a file, offers many data types, and lets you style the data-entry form.

CIRCLE 413 ON READER SERVICE CARD

vides nearly unlimited capacity.

The program's Main Menu is split into two submenus, one to create data files and the other to add records, update information, search for data, and generate reports. The program commands are generally straightforward, although very few screens have on-line help.

The screens in *filePro* have a simple, clean layout. You can set the foreground and background colors as well as the reverse video colors to display command keys and to add pizzazz to the title and field labels. You can also paint color into areas on the data-entry screens, customize by placing the entry fields anywhere on-screen, and use lines and boxes to highlight and separate groups of fields.

USING PLAIN ENGLISH

Setting up a *filePro* data file is quite simple. You start with a screen that displays numbered blank fields with columns for the name, length, and type. You can have up to 999 fields per record, 16 of which you can see simultaneously on the definition screen. You can define field names in plain English—up to 40-characters long—instead of stunted eight-character headings with underlines.

The field types include alphanumeric, numeric, date, and time formats. *filePro* includes ten special field types so you can convert all letters to uppercase or turn dollar amounts into words. You can also

SUITABILITY TO TASK

filePro Plus

Data loading and access	☒	☒	☒	☐
On-line inquiry	☒	☒	☐	☐
Ad hoc reporting	☒	☒	☐	☐
Professional applications development	☒	☒	☐	☐
End-user applications development	☒	☒	☐	☐

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preview with ZOOM!**

R&R Report Writer™



CIRCLE 315 ON READER SERVICE CARD

COVER STORY

RELATIONAL DATABASES



RELATIONAL DATABASES: SUMMARY OF FEATURES

Products listed in ascending price order

	1 on 1 = 3 Integrated	VP-Info Professional	Condor3	Ramis/PC Workstation	Ingres	Superbase 4
List price	\$99	\$189	\$395	\$595	\$695	\$695
Disk space required for installation	1.5MB	2MB	698K	2MB	1.1MB	4MB
MEMORY						
Expanded memory support	■	□	■	□	■	■
Minimum required	64K	N/A	None	N/A	None	None
Extended memory support	□	□	■	□	□	■
Minimum required	N/A	N/A	None	N/A	N/A	None
Includes disk cache	□	□	□	□	□	□
Supports mouse	□	□	□	■	□	■
DATA MANIPULATION LIMITS						
Maximum column/field size (bytes)	254	254	127	77	2,008	4,000
Maximum row/record size (bytes)	4,000	4,000	1,024	45,000	2,008	Unlimited
Maximum number of:						
Fields per record	128	500	127	255	127	Unlimited
Indexed fields per record	Unlimited	Unlimited	8	25	127	999
Indexes per database	Unlimited	Unlimited	65,534	25	Unlimited	999
Joined tables	10	Unlimited	127	11	10	255
Open files/tables	10	65	3	11	Unlimited	Unlimited
Records per table/file	1 billion	2 billion	65,534	666 million	Unlimited	1 billion
Records per database	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Tables/files per database	Unlimited	Unlimited	65,534	11	Unlimited	Unlimited
Tables per view	10	Unlimited	127	20	10	255
Views per database	Unlimited	Unlimited	65,534	20	Unlimited	Unlimited
DATA TYPES AND LIMITS						
Arrays:						
Boolean	■	■	□	□	□	■
Date	■	■	■	■	■	■
Dimensioned	■	■	■	□	□	■
Fixed-character	■	■	■	■	■	□
Fixed-decimal	■	■	■	■	□	■
Floating-point decimal	□	□	□	■	■	■
Integer	■	■	■	■	■	■
Time	□	□	□	■	■	■
Variable-length	□	□	□	□	□	■
Variable-character	□	□	□	■	■	■
Other	Memo field	None	Currency	Memo field	None	None
ACCESS METHODS						
Filing system:						
Proprietary	□	■	■	■	■	■
dBASE III	□	■	□	□	□	■
dBASE IV	□	■	□	□	□	■
Other	FoxBase	dBASE II	None	None	None	None
Automatic file resizing	□	□	■	□	□	□
INDEXING						
Composite field indexes	■	■	■	■	■	■
Definable exclusion list	□	■	□	■	□	□
Optional indexing of key	■	■	■	■	■	□
Supports automatic indexing	■	■	■	■	■	■
Can be turned on and off	■	N/A	■	■	N/A	□
Supports uniques	■	□	■	■	■	■
Indexes supported:						
B-tree	□	■	□	■	■	■
Clustered B-tree	□	□	□	□	■	□
Hashed	□	□	□	□	□	□
Other	FoxBase	None	Proprietary	Proprietary	Compressed B-tree	Derivative B-tree

■—Editors' Choice ■—Yes □—No

N/A—Not applicable: The product does not have this feature.

filePro Plus	Clarion Professional Developer	DataEase	dBASE IV	PC FoxPro	PC Paradox	R:BASE	Advanced Revelation	Omnis 5
\$699 3.5MB	\$795 6.8MB	\$795 1.3MB	\$795 3.5MB	\$795 3.8MB	\$795 2.6MB	\$795 4.5MB	\$995 5.9MB	\$1,000 2.5MB
☐ N/A	☐ N/A	☒ None	☒ 64K	☐ N/A	☒ None	☒ None	☒ 512K	☒ None
☐ N/A	☒ None	☒ None	☒ 64K	☐ N/A	☒ None	☒ None	☐ N/A	☒ 1.2MB
☐	☐	☒	☒	☐	☒	☐	☐	☐
☐	☐	☐	☐	☒	☐	☒	☒	☒
999 65,400	64,000 64,000	255 4,000	254 4,000	254 4,000	255 4,000	4,096 4,096	64,000 64,000	32,000 81,600
999	255	255	255	255	255	400	64,000	255
16	255	254	100	25	255	400	Unlimited	12
Unlimited	252	508,000	4,700	25	256	800	Unlimited	720
21	Unlimited	60	8	25	24	2	Unlimited	N/A
21	Unlimited	60	Unlimited	Unlimited	Unlimited	80	Unlimited	60
1 billion	Unlimited	16 million	1 billion	1 billion	2 billion	2 billion	Unlimited	Unlimited
Unlimited	Unlimited	32 billion	1 billion	1 billion	Unlimited	2 billion	Unlimited	Unlimited
Unlimited	252	2,000	Unlimited	Unlimited	Unlimited	80	Unlimited	60
Unlimited	Unlimited	32	10	25	10	5	Unlimited	Unlimited
Unlimited	Unlimited	2,000	Unlimited	Unlimited	Unlimited	80	Unlimited	Unlimited
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None	Short/long	None	None	None	Currency	Currency	Currency	Sequence number
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None	Binary, ASCII	None	None	None	None	None	ASCII	None
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☐	☐	☒	☒	☒	☒	☒	☒	☒
☐	☐	☐	☐	☐	☐	☐	☐	☐
Binary tree	Modified B-tree	None	None	None	None	None	Relational, cross-referencing	None

CONTINUES

COVER STORY

RELATIONAL DATABASES



RELATIONAL DATABASES: SUMMARY OF FEATURES

Products listed in ascending price order

	1 on 1 = 3 Integrated	VP-Info Professional	Condor3	Ramis/PC Workstation	Ingres	Superbase 4
DATA DEFINITION/INTEGRITY						
Data dictionary	■	■	■	■	■	■
File catalog	■	■	■	■	■	■
Data validation:						
Data ranges	■	■	■	■	■	■
Data-type enforcement	■	■	■	■	■	■
Pattern match	■	■	■	■	■	■
Rule-based	■	■	■	■	■	■
Specific match	■	■	■	■	■	■
Table lookups	■	■	■	■	■	■
Unique-value enforcement	■	■	■	■	■	■
User-definable	■	■	■	■	■	■
Referential integrity:						
Cascade	■	■	■	■	■	■
Nullify	■	■	■	■	■	■
Restrict	■	■	■	■	■	■
Requires primary key	■	■	■	■	■	■
Supports composite key	■	■	■	■	■	■
QUERY FACILITIES						
Query language:						
ANSI	■	■	■	■	■	■
dBASE compatible	■	■	■	■	■	■
DB2	■	■	■	■	■	■
ISO	■	■	■	■	■	■
Proprietary	■	■	■	■	■	■
SQL compatible	■	■	■	■	■	■
Query interface:						
Command line	■	■	■	■	■	■
Menu-driven	■	■	■	■	■	■
Query by form	■	■	■	■	■	■
Query by example	■	■	■	■	■	■
Stores queries	■	■	■	■	■	■
Includes precompiler/optimizer	■	■	■	■	■	■
Recursive (nested) select	■	■	■	■	■	■
Maximum number of search fields	Limited by command line	Limited by command line	127	127	127	Unlimited
Search parameters:						
AND	■	■	■	■	■	■
Case-sensitive	■	■	■	■	■	■
Equal	■	■	■	■	■	■
Greater than	■	■	■	■	■	■
Greater than or equal to	■	■	■	■	■	■
Less than	■	■	■	■	■	■
Less than or equal to	■	■	■	■	■	■
Limit occurrences	■	■	■	■	■	■
Nested search	■	■	■	■	■	■
NOT	■	■	■	■	■	■
Not equal	■	■	■	■	■	■
OR (inclusive)	■	■	■	■	■	■
Pattern match	■	■	■	■	■	■
Range	■	■	■	■	■	■
Substring	■	■	■	■	■	■
Wildcard	■	■	■	■	■	■
Relational operators:						
Difference (MINUS)	■	■	■	■	■	■
Divide (DIVIDEBY)	■	■	■	■	■	■
Intersect	■	■	■	■	■	■

PC — Editors' Choice ■ — Yes □ — No

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CIRCLE 721 ON READER SERVICE CARD

COVER STORY

RELATIONAL DATABASES



RELATIONAL DATABASES: SUMMARY OF FEATURES

Products listed in ascending price order

	1 on 1 = 3 Integrated	VP-Info Professional	Condor3	RamIs/PC Workstation	Ingres	Superbase 4
QUERY FACILITIES (continued)						
Join	☐	☐	☒	☒	☒	☒
Natural	☐	☒	☒	☒	☒	☒
Outer	☐	☐	☒	☒	☐	☐
Product (TIMES)	☐	☐	☒	☒	☒	☐
Project	☐	☐	☒	☒	☒	☒
Select (WHERE)	☐	☒	☒	☒	☒	☒
Union	☐	☐	☒	☒	☒	☒
DATABASE LANGUAGE FEATURES						
Language type:						
Compiled	☐	☒	☐	☐	☐	☐
Interpreted	☒	☐	☒	☐	☒	☒
Supports embedded SQL language	☐	☐	☐	☐	☒	☐
DATABASE LANGUAGE FUNCTIONS						
Aggregate functions:						
Average	☐	☒	☒	☒	☒	☒
Count	☒	☒	☒	☒	☒	☒
Date and time	☒	☒	☒	☒	☒	☒
Financial	☐	☐	☐	☒	☐	☒
Logical	☒	☒	☒	☒	☒	☒
Maximum	☐	☒	☒	☒	☒	☒
Minimum	☐	☒	☒	☒	☒	☒
Subtotals	☒	☒	☒	☒	☒	☒
Totals	☒	☒	☒	☒	☒	☒
Mathematical functions:						
Arithmetic	☒	☒	☒	☒	☒	☒
Numeric	☒	☒	☒	☒	☒	☒
Transcendental	☐	☒	☐	☐	☒	☒
Trigonometric	☒	☒	☐	☐	☒	☒
Operating system functions	☒	☒	☒	☒	☒	☐
Statistical functions:						
Standard deviation	☐	☐	☐	☒	☐	☒
Variance	☐	☐	☐	☒	☐	☒
String functions	☒	☒	☒	☒	☒	☒
MACRO CAPABILITIES						
Automatic recording	☒	☒	☐	☐	☐	☒
Keystroke memory macros	☒	☒	☐	☐	☐	☒
Macro language	☐	☒	☐	☒	☐	☒
SECURITY						
Application encryption	☐	☐	☐	☐	☐	☒
Data encryption	☐	☐	☐	☒	☐	☐
Password protection:						
Database	☐	☐	☐	☒	☐	☒
Dictionary	☐	☐	☐	☒	☐	☒
Field	☐	☐	☐	☐	☐	☒
Record	☐	☐	☐	☐	☐	☐
Table	☐	☐	☐	☒	☐	☒
User	☐	☐	☐	☒	☐	☒
Restricted access levels:						
Database	☐	☐	☐	☒	☒	☒
Dictionary	☐	☐	☐	☒	☒	☒
Field	☐	☐	☐	☐	☒	☐
Record	☐	☐	☐	☒	☒	☐
Restricted commands	☐	☐	☐	☒	☒	☐
Table	☐	☐	☐	☒	☒	☒
User	☐	☐	☐	☒	☒	☒

—Editors' Choice ☒—Yes ☐—No

COVER STORY

RELATIONAL DATABASES

filePro Plus	Clarion Professional Developer	DataEase	dBASE IV	PC FoxPro	PC Paradox	R:BASE	Advanced Revelation	Omnis 5
☐	☐	☐	☐	☐	☐	☐	☐	☐
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COVER STORY

RELATIONAL DATABASES



RELATIONAL DATABASES: SUMMARY OF FEATURES

Products listed in ascending price order

	1 on 1 = 3 Integrated	VP-Info Professional	Condor3	Ramis/PC Workstation	Ingres	Superbase 4
VERSIONS FOR OTHER ENVIRONMENTS						
Apple/Macintosh	☐	☐	☐	☐	☒	☐
Microsoft Windows	☐	☐	☐	☐	☒	☒
OS/2	☐	☐	☐	☐	☒	☐
Unix, Xenix, VMS	None	None	None	None	None	None
MULTIUSER SUPPORT						
Update refresh	☐	☐	☐	☒	☐	☐
Lock types:						
Coordinated	☐	☒	☐	☒	☐	☒
Exclusive	☐	☒	☐	☒	☐	☒
File lock	☐	☒	☐	☒	☒	☒
Record lock	☐	☒	☐	☒	☐	☒
Timeout/retry control	☐	☒	☐	☒	☒	☐
Write-only	☐	☒	☐	☒	☐	☒
Identifies station with lock	☐	☐	☐	☐	☐	☒
Maximum concurrent users	1	Limited by LAN	1	Limited by LAN	1	61
Networks supported:						
Banyan's VINES	☐	☐	☐	☒	☐	☒
LAN Manager	☐	☒	☐	☐	☐	☒
Novell's NetWare	☐	☒	☐	☒	☐	☒
3Com	☐	☐	☐	☐	☒	☐
Other	None	LANTastic	None	None	DECnet	Any Windows-compatible NOS
Gateways supported	None	None	None	None	RdB/VMS	None
IMPORT/EXPORT						
Standard file formats:						
ASCII	☒	☒	☒	☒	☒	☒
.DBF	☒	☒	☐	☒	☒	☒
.DIF	☐	☐	☐	☒	☒	☒
.PFS	☐	☐	☐	☐	☐	☐
.SDF	☒	☒	☐	☐	☐	☒
SYLK	☐	☐	☐	☐	☒	☐
User-defined	☐	☒	☒	☐	☐	☐
.WK1	☐	☐	☐	☒	☒	☒
.XLF	☐	☐	☐	☐	☐	☒
Other	None	None	Wang (export only)	None	.WKS	.LGX
APPLICATIONS DEVELOPMENT TOOLS						
Applications generator	☐	☐	☒	☒	☒	☐
Program editor	☒	☒	☐	☒	☐	☒
Menu generator	☐	☐	☒	☒	☒	☒
Multitable access	☒	☒	☐	☒	☒	☒
Runtime version	☐	☒	☒	☐	☒	☒
Data Entry/Forms Tools:						
Cursor	☐	☒	☒	☒	☒	☒
Default entry values	☐	☐	☒	☒	☒	☒
Default screens	☒	☒	☐	☐	☒	☒
Edit masks	☒	☒	☒	☒	☒	☐
Forced uppercase	☒	☒	☒	☐	☒	☒
Input/output conversion	☐	☒	☒	☒	☐	☒
Move/copy functions	☒	☒	☐	☒	☒	☒

—Editors' Choice ☒—Yes ☐—No

COVER STORY RELATIONAL DATABASES

filePro Plus	Clarion Professional Developer	DataEase	dBASE IV	 FoxPro	 Paradox	R:BASE	Advanced Revelation	Omnis 5
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Unix	None	Unix	Unix, VMS	Unix, Xenix	None	None	None	Unix
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Limited by LAN	1	128	Limited by LAN	Limited by LAN	Limited by LAN	Limited by LAN	Limited by LAN	451
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Any NetBIOS-compatible NOS	Any NetBIOS-compatible NOS	PC LAN	PC LAN	Any NetBIOS-compatible NOS	IBM Token-Ring	PC LAN	None	TOPS
None	None	Microsoft SQL Server	None	None	IBM EE, Microsoft SQL Server, Oracle, RdB/VMS	None	None	DAL, Microsoft SQL Server, Oracle, Sequelink Mac/PC, Sybase
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None	None	None	Framework, RapidFile	None	Reflex, Symphony, WKQ, VisCalc	.WKS	None	None
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☒	☒	☒						

dFacts Are In.

DATABASE COMPARISON TABLE	dBASE IV version 1.1	Paradox version 3.5	FoxPro version 1.02
EASE OF USE			
Control Center organizes data, queries, forms, reports, labels, applications on <u>one</u> screen	Yes	No	No
Create applications <i>without programming</i>	Yes	Yes	No
Modern pulldown menus for all Design Tools	Yes	No	Limited
Query by Example (QBE) for easy access to information	Yes	Yes	No
Context specific help by menu item	Yes	No	No
PRODUCTIVITY			
Quick Layout for automatic forms, reports and labels	Yes	No	Yes
Application Generator for quick application development	Yes	Yes	No
Automatic code generation for all Design Tools	Yes	No	No
Automatic maintenance of <u>multiple</u> indexes for ordering data	Yes	No	No
Memo fields for notes, letters, descriptions	Yes	No	Yes
POWER & FLEXIBILITY			
Bold, underline, italic, subscript, superscript text for high impact reports and labels	Yes	No	No
User Defined Functions for extending programming language	Yes	No	Yes
Data input validity checking in forms	Yes	Yes	Yes
Multi-user transaction processing ensures data integrity	Yes	No	No
Number of file formats imported/exported	7	6	3
INDUSTRY STANDARDS			
#1 Selling, #1 Rated multiuser database; over 3 million users (1)(2)	Yes	No	No
Compatible with dBASE III PLUS data and applications	Yes	No	Yes
Compatible versions for DOS, VAX VMS, Macintosh, SunOS and other UNIX platforms (3)	Yes	No	Limited
Structured Query Language (SQL) integrated with programming language	Yes	No	No

(1) dBASE III PLUS and dBASE IV comprise approximately 55% of PC database systems sold (3 times nearest competitor) according to the most recent report by the market research firm Audits & Surveys (Oct. 1990) (2) Software Digest rated dBASE IV #1 among multiuser databases, October 1990 (3) Versions of dBASE IV are shipping for DOS, VAX, and SunOS. Macintosh and other UNIX Platforms are announced

Based on what our customers tell us, we made a list of some of the most important features to look for in data management software.

Then we compared the new dBASE IV® version 1.1 with two other database products.

As you can see, dBASE IV offers exclusive advantages in

many categories.

For instance, only dBASE IV lets you access all its functions from a single screen. Called the Control Center, this screen lets you manage existing data, and create new tables, queries, reports, forms and labels totally without programming.

When all the facts are on the table, it's easy to see which database software is best.

Of course we aren't the only ones who have come to this particular conclusion.

Software Digest rates dBASE IV version 1.1 the #1 Multiuser Database (Vol. 7, No. 13, Oct. '90).

Truth Comes Out.

Perhaps the most independent publication in the industry, *Software Digest* accepts no advertising whatsoever. Corporations pay hundreds of dollars a year to receive their monthly reviews—which are considered highly unbiased and objective. Their exhaustive, 75-page report concludes:

"Among the top ranking programs, dBASE IV (version 1.1) is the most well-rounded, with solid performance, versatility, and usability." Commenting on speed, *Software Digest* points out that "dBASE IV produces all three test reports as fast as or faster than FoxPro/LAN." As for Ease of Use and Ease of Learning, dBASE IV scored in the Excellent Range as many times as any other multiuser database product tested.

For a free evaluation kit, including competitive details and a free demo disk, call toll-free: 1-800-437-4329 ext. 1416. Better yet, call 1-800-2ASHTON to upgrade to the new dBASE IV now.

The truth is, no other database can do so much to improve productivity.

Software Digest

RATINGS REPORT

Volume 2 Number 13

The Independent Comparative Ratings Report
for Selecting IBM PC Business Software

MULTIUSER DATABASE PROGRAMS

Ratings Key: ■ 70-100 ■ 50-69 ■ under 50

Software Digest Rating	Overall Evaluation	Overall Power	Program Name	Version Tested	Performance	Reliability	Error Handling	Ease of Learning	Ease of Use	Memory Requirement	Price	Volume Purchase Agreement	Page
***	70	67	dBase IV	1.1	■	■	■	■	■	450KB	\$795	✓	28
**	6.8	51	Paradox	3.5	■	■	■	■	■	640KB	\$995	✓	32
**	6.8	71	FoxPro/LAN	1.02	■	■	■	■	■	512KB	\$1,095	✓	30
**	6.4	51	DataEase	4.2	■	■	■	■	■	640KB	\$750	✓	28
*	5.8	3.6	R:Base	3.0	■	■	■	■	■	520KB	\$995	✓	34
*	5.7	6.0	Clarion Professional Developer	2.1	■	■	■	■	■	512KB	\$845	✓	24
*	5.7	6.6	Advanced Revelation	2.01	■	■	■	■	■	640KB	\$995	✓	22

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dBASE IV



Ashton-Tate



RELATIONAL DATABASES: SUMMARY OF FEATURES

Products listed in ascending price order

	1 on 1 = 3 Integrated	VP-Info Professional	Conдор3	Ramis/PC Workstation	Ingres	Superbase 4
APPLICATIONS DEVELOPMENT TOOLS (continued)						
Multifield keys	■	■	■	■	■	■
Multirecord entry	■	■	■	■	■	■
Multitable display	■	■	■	■	■	■
Multitable entry	■	■	■	■	■	■
Required fields	■	■	■	■	■	■
Retain values from previous record	■	■	■	■	■	■
Screen coordinates	■	■	■	■	■	■
Report generator	■	■	■	■	■	■
Form-based reports	■	■	■	■	■	■
Aggregate functions in reports:						
Average	■	■	■	■	■	■
Count	■	■	■	■	■	■
Maximum	■	■	■	■	■	■
Minimum	■	■	■	■	■	■
Override column/field names	■	■	■	■	■	■
Override field formats	■	■	■	■	■	■
Subtotal on breaks	■	■	■	■	■	■
Sum	■	■	■	■	■	■
Maximum number of break fields	2	2	8	N/A	127	Unlimited
Maximum number of report variables	Unlimited	30 columns	Unlimited	127	N/A	Unlimited
Presentation display:						
Cross-tabs	■	■	■	■	■	■
Graphs	■	■	■	■	■	■
Debugging functions:						
Breakpoints	■	■	■	■	■	■
Error handling	■	■	■	■	■	■
Single-step execution	■	■	■	■	■	■
User-defined	■	■	■	■	■	■
Watchpoints	■	■	■	■	■	■
Link libraries/languages:						
Assembler	■	■	■	■	■	■
BASIC	■	■	■	■	■	■
C	■	■	■	■	■	■
Pascal	■	■	■	■	■	■
Transaction definition	■	■	■	■	■	■
Supports commit and rollback transactions	■	■	■	■	■	■
PRINTER SUPPORT						
Printer drivers included:						
Epson and IBM	■	■	■	■	■	■
Hewlett-Packard and PCL	■	■	■	■	■	■
PostScript	■	■	■	■	■	■
Supports installable fonts	■	■	■	■	■	■
Supports user-customizable drivers	■	■	■	■	■	■
HELP						
Differentiated help levels	■	■	■	■	■	■
Displays help messages	■	■	■	■	■	■

■—Editors' Choice ■—Yes □—No

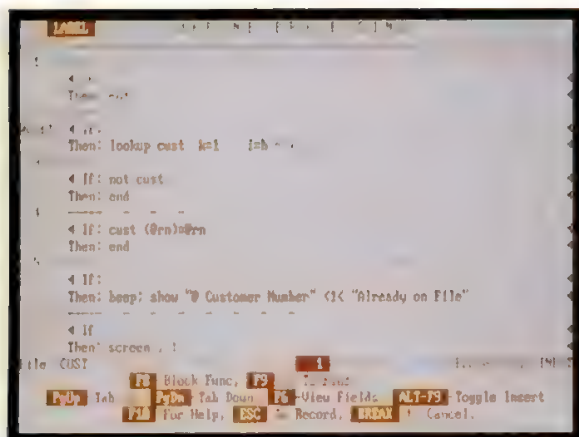
N/A—Not applicable: The product does not have this feature.

COVER STORY

RELATIONAL DATABASES

[illegible]

ENDS



In *filePro Plus* you can define input processing routines that will run when you enter or leave a data field. These routines are written into a predefined If/Then format. Some of the statements are clear, but others can be understood only if you're familiar with *filePro's* language.

create your own field types for data such as product number, cost code, or tax rate. Most new field types require just a line or two of programming, and you can test them before you use them.

The initial step in creating a data file takes just minutes. The result is a default data-entry screen with columns of fields in the order you defined, a default report, and indexes you selected.

The next step is to create data-entry screens by placing fields on-screen wherever you want them, adding color, and drawing boxes. As you're working, you can call up a list of fields to display their length and type, and you can define as many screens as you need.

Once you've defined a data file, you can use it for up to 161 unique sets of data. The difference from one set to another is the data itself, the number of records, and the indexes. *filePro* is clever in its ability to let you separate data from different offices or regions or maintain the same application for different clients without duplicating file definitions.

A VERY BASIC BASIC

While *filePro* lets you build a data file via menus and built-in commands, the real power of the program comes from its processing language, which is a stripped-down version of BASIC with only the If/Then statement. You can write five different types of program scripts: Automatic,

Input, When, Output, and Sort/Selection. *filePro* uses Automatic processing to create look-up boxes, to calculate the number of days since the last update to a record, to chain tables together, or to execute other operations that are independent of data entry. Input processing lets you program operations with data so you can write a processing routine to

look up the description of a product based on a product number entry, and then place that description in the appropriate field. The program script referred to as When processing lets you create pop-up messages that are activated at a particular field.

The commands in *filePro's* programming language are generally quite straightforward—GETNEXT works on repetitive lookups and MAX finds the maximum value in a field—but you have to get the syntax of a program statement correct or it won't work. *filePro* checks syntax for you and indicates errors, but it won't catch every one. Thankfully, the package includes a thorough Quick Reference Guide and comes with good tutorial and reference manuals.

Creating user menus is one function you don't execute with the processing language. You can customize the *filePro* system through the Define User Menus option on the Main Menu. Your options include single- or two-column menus, and you can indicate exactly which files, formats, indexes, and selection sets the system should use for each operation. You do have to write action lines with simple syntax to accomplish this.

MULTIPLE INDEXES AND SCANS

When it comes time to search your data files, *filePro* provides very good facilities, though its overall speed on the benchmark tests was only average across the board. To start, you can have 16 Automatic indexes and ten Demand indexes with complex record selection and sorting. The Demand indexes save a great deal of time. You can read records one at a time, or if you toggle to Browse mode, you can see many records at once in a columnar format.

In Browse mode you can also do a "fuzzy" search, which uses a pattern-of-characters algorithm to find the closest matches to a value. *filePro's* most thorough searching methods are its Short Scan and Extended Scan. The Short Scan works fine with unindexed information or with only a couple of criteria. For other information, you would use the Extended Scan, which can have up to 72 criteria. You can also save and reuse Extended Scans.

You use the Extended Scan screen also to select records for reports. To establish the format of a report, you use the Define Outputs selection on the Main Menu. In addition to generating reports, you can define mailing-label output or other printed output. In a report, you set the page size, select fields, indicate how to sort, and then paint them on the report page. *filePro's* Report screen includes areas for a heading, titles, data lines, and totals.

filePro is a simple system that lets you create data files, menus, and reports with no programming at all, making it a good choice if you want a ready-to-use package. Its easy-to-learn processing language also makes it a good choice for users who want to customize the program and develop complex applications. With *filePro*, you can choose when you want to become a programmer.

FoxPro

by Richard Hale Shaw

If you're looking for a database that offers a host of features and tools for developers, along with the speed and ease that end users demand, a package that's compatible with industry-standard file formats and database languages without being entrenched in the technology of the mid-

SUITABILITY TO TASK

FoxPro

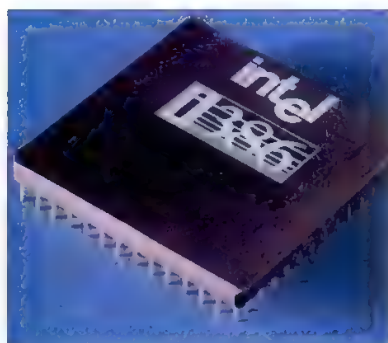
Data loading and access				
On-line inquiry				
Ad hoc reporting				
Professional applications development				
End-user applications development				

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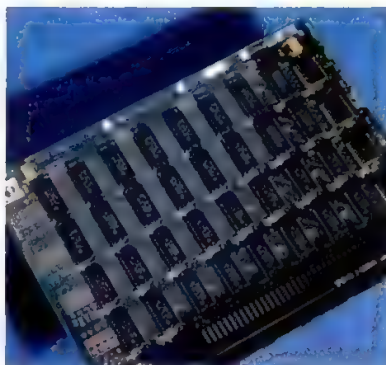
CompuAdd's Hot Slots Boost 333T Performance



Look inside the CompuAdd 333T. You'll see what prompted *PC Magazine* to call it "a speed demon" and "a power user's dream machine" in its review of 45 leading 33MHz 386 computers.

You'll see CompuAdd-exclusive "hot slots": two 16-bit expansion slots designed to maximize the performance of the CompuAdd HardCache/ESDI controller card and CompuAdd Hi-Rez VGA card. (Each slot still works perfectly with a standard 16-bit expansion card, should you choose that option.) And you'll see a motherboard designed by CompuAdd to take maximum advantage of the optional, ultra fast SRAM card.

Now, run the 333T. You'll see the speed that makes it the **fastest 33MHz 386** computer you can buy — as measured by top scores on *seven of nine* PC Labs benchmarks, including the 386 Instruction Mix Text. In its review, *PC Magazine* said the CompuAdd 333T "scored the best time in the group, or close to it, on every test we put it through, boasting the best overall performance in the field."



The CompuAdd 333T is the right choice when you need **full-scale multitasking capabilities** in either a reliable network file server or a powerful standalone workstation.

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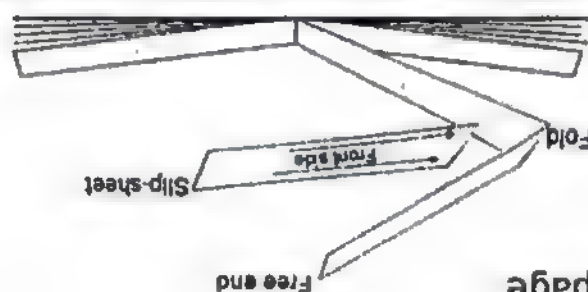
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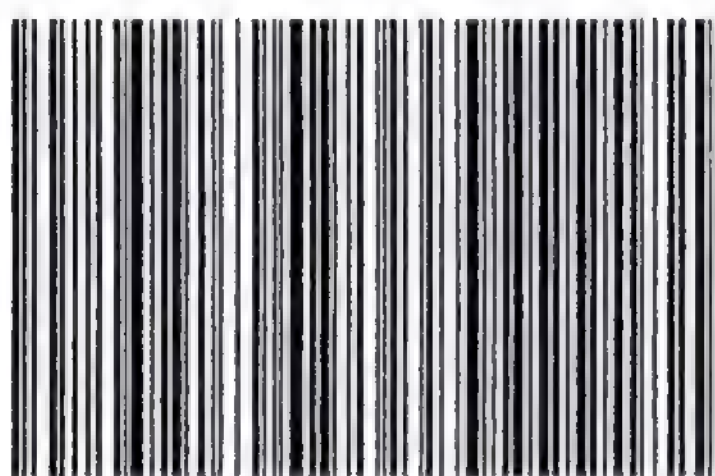
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1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet

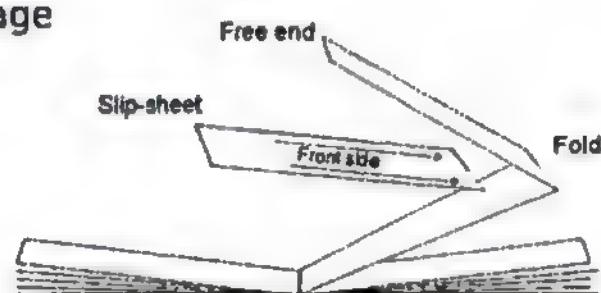


GbsSlipSheet-001

Folded edge of the page

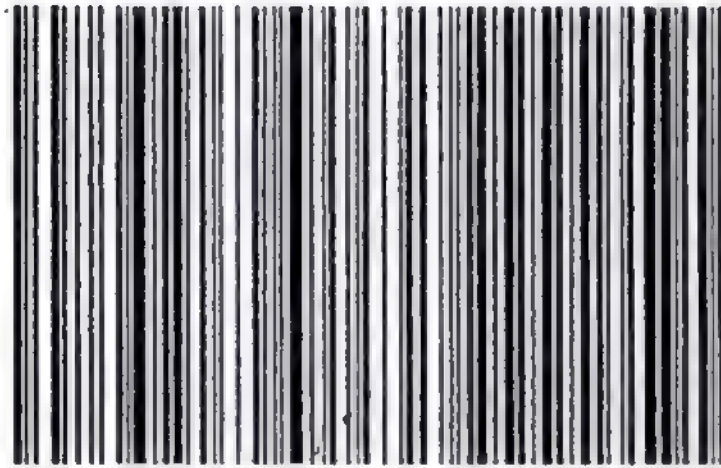
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



Gbs5llpBack-001B

Back

1. Follow instructions on the other side

COMPUADD 333T: BEST

Look Inside the "Power User's Dream Machine"

PC Magazine, December 25, 1990

\$2775



Five half-height internal drive bays.

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CompuAdd exclusive "hot slot" designed for maximum performance with the CompuAdd HardCache/ESDI controller.

CompuAdd exclusive "hot slot" designed for maximum performance with the CompuAdd HardCache/ESDI controller.

The only award quality computer throughout (PC Magazine)

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CompuAdd 333T: Best Overall Performance



CompuAdd 333T

The 333T is a proven winner, picked as Editors' Choice in *PC Magazine*, December 25, 1990! And picked as a finalist for *PC Magazine's* 1990 PC Technical Excellence award! It's the *fastest 33MHz 386 system you can buy* — as determined by top scores on seven of nine PC Labs benchmarks. In selecting the 333T as Editors' Choice, the editors credited the CompuAdd 333T with "the best overall performance in the field."

CompuAdd 333 Full Profile

The CompuAdd 333 Full Profile desktop system delivers the same performance as the 333T in a slimmed-down case. It sports three half-height front access and two half-height internal 5.25" drive bays, six 16-bit and one 8-bit expansion slots. Plenty of room to add extra drives and option cards.



Whether used as network servers or as powerful standalone workstations for CAD/CAM, database management, spreadsheet applications or desktop publishing, the CompuAdd 333T and 333 give you the fastest 32-bit computing power you can get in a 33MHz 386 system!

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vendor-neutral survey asked PC users how satisfied they are with their PC purchases. CompuAdd received the best endorsement any manufacturer could ask for: #1 for Value/Price, Quality, Commitment to the Customer and Overall Satisfaction! That's right. CompuAdd beat 25 leading PC manufacturers, including IBM, Compaq, Apple and Hewlett-Packard!

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- One built-in parallel and two serial ports
- 80387 or Weitek 3167 math coprocessor socket
- FREE CompuAdd Windows 3.0
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CompuAdd 333T Base System:

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333 80MB	66667 - \$3395	66668 - \$3875
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* Includes 5.25" 1.2MB and 3.5" 1.44MB high-density diskette drives.

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COVER STORY RELATIONAL DATABASES



FoxPro, Version 1.02

Fox Software Inc., 134 W. South Boundry,
Perrysburg, OH 43551; 419-874-0162.

List Price: \$795.

Requires: 420K RAM, DOS 2.0 or later.

In Short: A high-performance, dBASE-compatible database with an elegant interface and powerful programming facilities for the developer. While not nearly as friendly as it should be for end users, this package is a developer's paradise.

CIRCLE #14 ON READER SERVICE CARD

eighties, you need look no further than *FoxPro*, Version 1.02.

This \$795 database from Fox Software has succeeded *dBASE* as the industry leader in innovation, power, and speed—a winning combination that earned an earlier version of the package an Editors' Choice. *FoxPro*'s mouseable, character-mode interface is nearly CUA-compliant, with pull-down menus, pop-up dialogs, list boxes, and scroll bars. The handy on-screen calculator, calendar, and even an ASCII chart compliment the standard menus.

In *FoxPro*, when you need to open a table and view its contents, you can forget USE and BROWSE: Click on the File Open pull-down menu, select the filename from the list box, and click on Edit Browse. The table you want to view appears in a movable, sizable window that glides across the desktop with breathtak-

ing speed. If you prefer the dot-prompt approach, a Command window will accept *dBASE* language commands just like the old dot prompt did.

A DEVELOPER'S PARADISE

A snappy interface isn't all that *FoxPro* offers: developers will find a number of valuable tools and features in the package. When compared with its predecessor, *FoxBase Plus*, *FoxPro* is packed with over 200 enhancements to its dialect of the *dBASE* language, and offers unusual features like variable-length memo fields. Functions are available to perform search and replace operations within a text field and perform low-level DOS file I/O. The first of the *dBASE* clones to offer User-Defined Functions (UDFs), *FoxPro* lets you pass parameters to UDFs by value or by reference.

Developers can take advantage of *FoxPro*'s interface in their applications. For instance, there are commands and

FOXPRO 2.0: New Tools, New Look

by Sal Ricciardi

One of the biggest database stories of 1991 will be the arrival of *FoxPro*, Version 2.0, later this year. The package promises to top the current version and further Fox's reputation for technical excellence. While it's too soon to draw any final conclusions, our early peek at a beta version convinced us that *FoxPro* 2.0 will be a significant competitor.

RUSHMORE TECHNOLOGY

One of the most notable features of *FoxPro* 2.0 is the new Rushmore query optimization technology. Rushmore uses a patent-pending technique to improve dramatically the access of indexed data for certain "optimizable" queries. According to Fox, the results will yield access to data "orders of magnitude" faster under the right conditions. Fox has demonstrated that certain operations perform thousands of times faster using this technology.

The Rushmore technique works automatically with existing applications and index files, but using it to the best advantage may require unlearning some of the tricks and techniques commonly used to improve perfor-

mance. For example, in current applications, slower commands are often replaced by alternatives, sometimes several commands long, that produce the same results only faster. With Rushmore technology, that practice will no longer be necessary—indeed, it should not be used because of Rushmore's ability to optimize simple commands.

While Rushmore offers some spectacular opportunities, *FoxPro* 2.0 seems quite fast even for operations that don't employ it. As an experiment, we ran our beta release of *FoxPro* 2.0 through our new relational database benchmark tests. The beta software completed the suite without errors and 21 percent faster than *FoxPro* 1.02. (While this is notable, the testing of beta software makes these results useless, except as a point of curiosity. Nevertheless, indications are that *FoxPro* 2.0 will be very fast.)

SQL users will no doubt take advantage of Fox's implementation of



FoxPro 2.0's screen builder allows you to design screens with buttons and scrollable text edit regions. Minimized windows will be supported, as will "one-to-many" relationships using the new SET SKIP TO command.

the SQL SELECT statement. With *FoxPro* 2.0, the SELECT command will be fully integrated with the command language and available at all times—there's no mode switch required. Since SELECT can perform operations that otherwise require several *FoxPro* commands, its use will be preferred in situations that use Rushmore because it will be easier for

CONTINUES

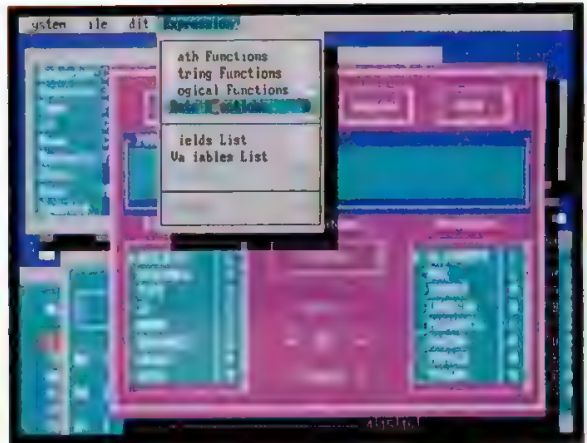
functions to let you create and manage windowing applications. A command clause, IN WINDOW, lets you create a parent-child relationship between two

Using *FoxPro's*
many utilities to
create new
applications is
a snap.

windows and constrains the child window to the boundaries of the parent. If you move, hide, or close the parent window, the child is moved, hidden, or closed with it. This allows for more-powerful, more-

intuitive application interfaces with less coding. And since you can modify and retrieve the values stored in the calculator and the calendar, you can make them an integral part of your own applications.

With *FoxPro*, creating a new application is a snap. You can use FoxView to design screens and generate applications code, FoxCode to design applications with a template language, and FoxDoc to document and cross-reference your source code. The FoxCode template language lets you create reusable application templates that relieve you of the details of assembling an application. FoxDoc can create cross-ref-



FoxPro offers a mouse-supported, windowing, CUA-style interface. It lets you use pull-down menus and pop-up dialog boxes instead of the traditional dot prompt, though you can still use the Command window to issue dot prompt commands.

New Tools, New Look

CONTINUED.

Rushmore to optimize. A new relational query-by-example (RQBE) screen lets you enter information and have *FoxPro* generate a SELECT statement for you.

OPEN ARCHITECTURE

Third-party developers will be pleased by *FoxPro's* new open architecture. Version 2.0's new external API provides access to much of *FoxPro's* internals. Using either C or assembler, developers can create external libraries of routines that are dynamically loaded and released as needed. With the API, programmers will be able to access databases, manipulate memory, process *FoxPro* statements and expressions, and use *FoxPro's* windowing and video routines. The API will provide access to *FoxPro's* event loop, letting developers handle *FoxPro* events and install custom event handlers.

You'll also be able to use some of *FoxPro's* interface enhancements in your own programs—things like radio buttons, check boxes, and text edit regions that you often see in graphical applications. *FoxPro* 2.0 will support all of these through enhancements to

the @ GET command and a new command, @ EDIT.

DEVELOPER'S TOOLS

Designing screens that use these enhancements will be made easier by a new object-oriented Screen Builder, which is part of a trio of tools that include the Menu Builder and the Project Manager. The Menu Builder will let you design, test, and generate code for menus, while the Project Manager will be almost a complete MAKE facility for programmers. You'll be able to list screens, menus, programs, libraries, and basically everything required for an application. Then the Project Manager will build the application.

The capability to build fully independent monolithic .EXE's will be a function of the Project Manager. It will be able to build .FXP applications that require a runtime module, single .EXE files, or a series of executable files that rely on a central *FoxPro* library.

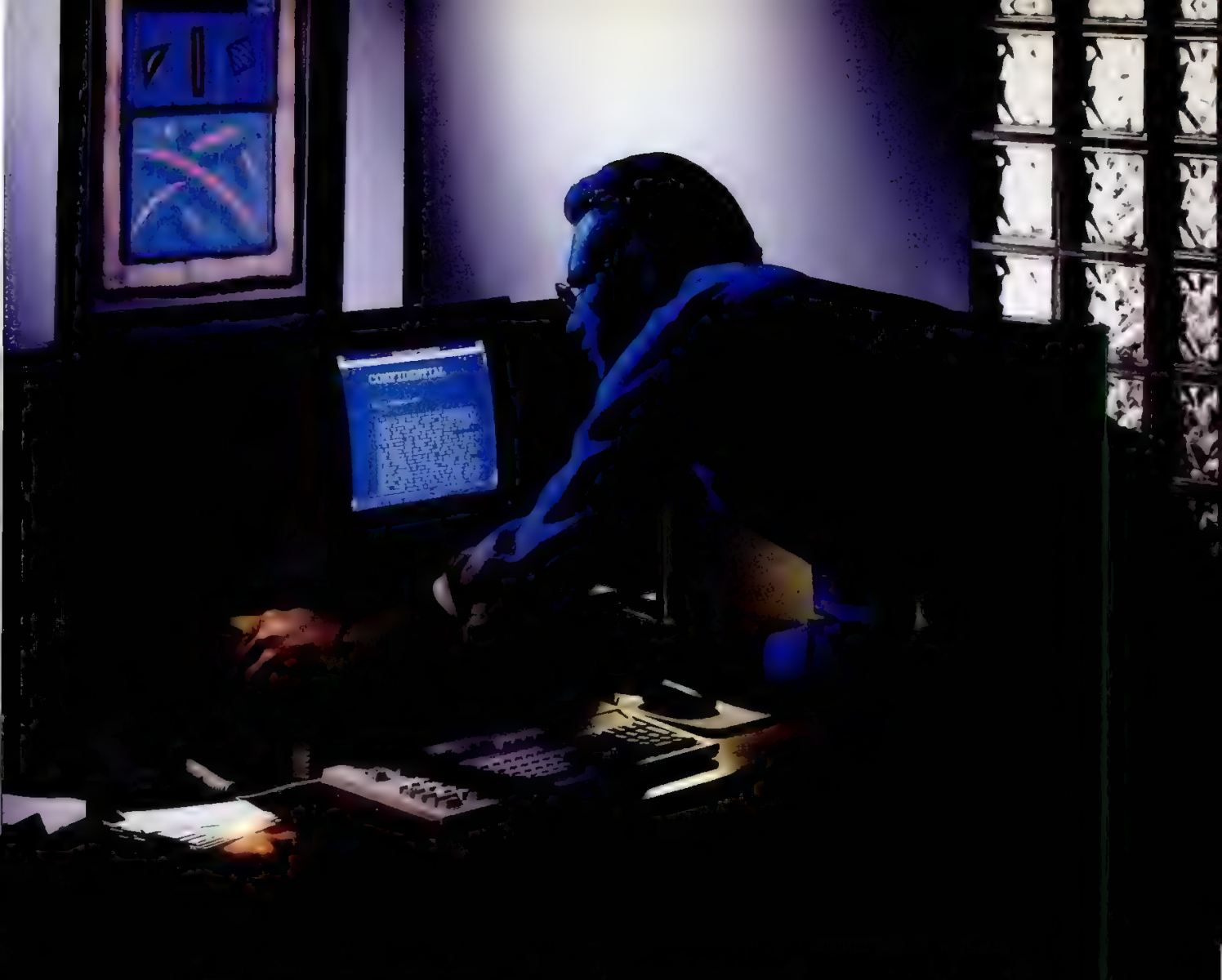
FoxPro 2.0 will also include new compound indexes that use a patent-pending compression technique to reduce index file size, a special extended-mode version for 386 and 486 machines, and integrated template processing. There's plenty to look forward to in Fox's next release. ■

erence reports on your program, display a tree diagram of its structure, and maintain a data dictionary. *FoxPro* will create programming language code with every menu choice, and as it is generated, display the code in a window at the bottom. You can see the results of code generation, edit the code, and immediately test the results. Additional windows are available to run the debugger and cut-and-paste code examples between source windows or from help file windows into your program.

GREAT PERFORMANCE

FoxPro is the performance leader, as well, placing first in the small and large Load and Index benchmark tests, the Project tests, the Report test, and the Output Overhead test. In addition, it landed in the top five on the Join and Select tests.

FoxPro is one of the few packages reviewed here (other than *Paradox* and *R:BASE*) that is not limited to using conventional memory. It can use LIM 4.0-compatible expanded memory (EMS), and comes with FOXQ.EXE, a program that uses the high memory available under QEMM-386 without disabling EGA/VGA graphics. The package reserves the first 64K of EMS for managing windows, menus, variables, and programs, and uses the remaining space as a disk cache. Considering that *FoxPro* runs in only 384K (but requires 420K RAM to load), there's quite a lot of space remaining for your



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applications, as well as any network drivers you have installed.

UPCOMING IMPROVEMENTS

What does *FoxPro* lack? It can't generate DOS .EXE files and cries out for a low-level Applications Programming Interface (API) that can be called by another language such as C. Further, there's still no support for SQL or any other set-oriented approach to managing a database. The *FoxPro* interface has its limitations, too. It's too oriented toward the underlying *dBASE* language commands: USE, BROWSE, APPEND, COPY, etc. As an end user, you may not know (and may not care) what these commands mean. You may simply want to open a table and view or modify its contents.

And finally, it's a shame that *FoxPro* didn't implement a multiple indexing scheme like *dBASE*'s .MDX files. After all, this technology has been around since *dBASE IV* first appeared in late 1988. Fortunately, Fox's new version *FoxPro* 2.0 was in beta testing at the deadline for this story, and many of these issues will be addressed in that product (see "FoxPro 2.0: New Tools, New Look").

If you've never used *FoxPro*, you're in for several delightful surprises. One of the best is Fox Software's money-back guarantee, which lets you try *FoxPro* for 30 days and return your copy if it fails to meet your expectations. But don't worry. There's little danger of that happening.

● Ingres by Katherine Emery

Ingres, from ASK Computer Systems, reveals its mainframe heritage in the ho-hum look and feel of the interface and in the awesome speed at which it carries out its tasks. For \$695, *Ingres*, Version 5.0, is

ideal for the company that wants to maintain centralized data on a mini or mainframe computer and utilize distributed processing on the PC level. Not only can *Ingres* handle large volumes of data easily and efficiently, but users will find the common interface among all platforms comforting.

To users accustomed to software with flashy screen design, *Ingres*' strictly business interface may seem stuffy. Printer driver and mouse support and the ability to create flashier screen forms would make *Ingres* more appealing to PC users. Although these features may seem strictly superficial to mainframe programmers, they do serve a purpose in PC-based organizations. Beneath the plain surface however, is the powerful engine for which we gave *Ingres* an Editors' Choice in a previous evaluation of SQL-based databases.

Ingres comes with clearly written documentation that is helpful to novices and experienced programmers. Telephone support is free for the first 90 days, but after that you must pay 15 percent of the product price with a minimum of \$3,000 per site. For sites with fewer than 25 installations, this is a steep price to pay for an important support function.

IMPRESSIVE SPEED

Can the database you now use load 10,000 records in under 3 minutes? How about 100,000 records in under 25 minutes? *Ingres* can, and did. Indexing was equally impressive during benchmark testing, taking under one and a half minutes to index 10,000 records and under 10 minutes for the 100,000-record file. *Ingres* was obviously built with large applications in mind. Most limitations are set by available disk space, and variable character fields maximize that space.

Programmers used to working with arrays will not find them here and will also have to work around the lack of Boolean and calculated fields. These omissions will add overhead to your applications, but with the ability to quickly generate indexes or even temporary data files on the fly, performance is unlikely to suffer. You can build indexes on up to 127 fields and turn indexes off and on to improve processing speed.

For command-line queries, you can use QUEL and SQL statements, or you can select options from a menu, query by

form, or query by example using the *Ingres* Fourth Generation Language. *Ingres* search parameters, database functions, and report/form generation tools are robust. Although macros are not supported and queries cannot yet be stored, the report and application generator can help fill in the gap.

REPORT CREATION

The report generator is not screen-based, but requires you to create a command file using commands like ".header," ".query," and ".sort," which describe the layout of your report. This discour-



Ingres, Version 5.0

ASK Computer Systems Inc., Ingres Products Div., 1080 Marina Village Pkwy., Alameda, CA 94501; 415-748-2675.

List Price: \$695

Requires: 640K RAM, DOS 2.1 or later.

In Short: *Ingres* is a speed demon with far more functionality than form, making it ideal for companies intending to have data on mainframes, minis, or microcomputers. The plain interface lends it a strictly business design. You won't find debugging or editing tools, but it's a powerful database engine with support for Assembler and C library links.

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SUITABILITY TO TASK

Ingres

Data loading and access				
On-line inquiry				
Ad hoc reporting				
Professional applications development				
End-user applications development				

ages the novice, and is more time consuming (even for the expert programmer) than screen-oriented report generators.

We were surprised to find no debugging tools or program editor, but were pleased to see support for Assembler and C library links. Further, you can convert your *Ingres* files into popular spreadsheet, database, and word processing file formats for further analysis and presentation capabilities.

The multiuser support functions are minimal, with locking possible only at the file level. *Ingres* does not allow for read-only access. No networks are currently supported and no gateways to other database servers exist.

The addition of financial, statistical, and substring functions would enhance the otherwise complete library. Security

COVER STORY RELATIONAL DATABASES

features restrict access down to the field level, but additional layers of security by way of encryption and password protection would make *Ingres* even more functional.



The *Ingres* table utility screen lets you build or dismantle database tables, identify their structure, and run queries and reports.

Ingres' interface will seem rather plain if your organization is strictly PC-based. If, however, yours is a more diverse world where you work with a distributed processing development environment of PCs, mainframes, and minis, or if speed is a high priority, take a look at *Ingres*—and remember that beauty is only skin deep.

● **Omnis 5** by Katherine Emery

If you think all innovative software packages are born on the West Coast, you'll be surprised at what the English company Blyth Software has packed into *Omnis 5*, Version 1.2. Perhaps its California branch has had an impact, but even by Silicon Valley standards, this \$1,000 *Microsoft Windows*-based database offers some very slick features, including cross compatibility between DOS and Macintosh machines, DDE (Dynamic Data Exchange) support, graphics, and sound storage capabilities. If you want a *Windows* database package that functions in a multiplatform microcomputer environment, take a good look at *Omnis 5*.

Working in the *Windows* environment, you use a mouse to access pop-up windows to run reports, conduct searches, and even develop your programs. You

design menus and screens through pull-down menus and place fields and graphics where you want them to appear on paper or screen. You can also resize graphics and change fonts for selections and titles. Once you get over the confusion of all those windows, you'll be in complete control with a minimum of fuss.

ONLY ONE CODING METHOD

Your feelings of mastery begin to wane, however, as you get further into coding and find that you cannot type in your own code but must choose program commands from menus. At this point, you may feel claustrophobic, but when you discover that you cannot use your trusty editor and are confined to the *Omnis 5* developer's environment, you may start rebelling. Once you're accustomed to this design, however, it's really not so bad.

When you type the first letter of the command you want, *Omnis 5* jumps directly to the commands that start with that letter. As you type, your selections are narrowed down. If you choose a command that has subcommands, the program displays them as choices under your selected command. You continue to flesh out your programming statement by choosing from submenus as you build your application.

To enter a field name into a command statement, you select the file and pop up the valid field choices. To enter a variable, you choose a declared variable from a file



FACT FILE

Omnis 5, Version 1.2
Blyth Software Inc., 1065 E. Hillsdale Blvd., #300, Foster City, CA 94404; 415-571-0222.
List Price: \$1,000.

Requires: 640K RAM, 1.2MB extended memory, *Microsoft Windows 2.x* or 3.0, DOS 3.1 or later. Mouse recommended.

In Short: A flashy but slow product for *Windows* users who don't require complicated program development. The package doesn't provide command-line control, so you must generate code through menu selections. It supports network operating systems with up to 451 concurrent users, includes file and record locking, and other security features.

CIRCLE 416 ON READER SERVICE CARD

of established variables. Once you get used to this procedure, typing is minimized, and syntax errors are practically eliminated.

KEEPING IT SIMPLE

Lack of command-line control may cramp your style, but a more serious problem arises from all of the indexes being constantly active and the inability to do multi-field indexing. This may make it virtually impossible to accomplish more-complicated programming efforts.

While some of the dirty work of coding, such as spell-checking, is eliminated, you'll spend far more time debugging more complicated flow control problems due to the event-driven nature of *Omnis 5*.

This design does allow flexibility, but for a programmer who is used to the linear flow of traditional programming languages like *dBASE* or *Cobol*, it will take some adjustment. Unfortunately, the only troubleshooting help available in addition to inserted comment commands is from third-party debugging tools.

From a database manager's point of view, the *Omnis 5* development environment has many advantages. You can create built-in documentation on-the-fly from existing code, eliminating the worry that documentation is inaccurate or outdated. The forced declaration of memory variable names and definitions precludes confusion and conflicts over usage. And

SUITABILITY TO TASK

Omnis 5

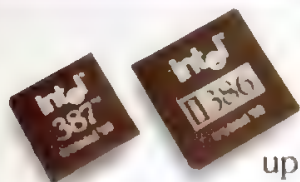
Data loading and access	☒	☒	☒	☒
On-line inquiry	☒	☒	☒	☒
Ad hoc reporting	☒	☒	☒	☒
Professional applications development	☒	☒	☒	☒
End-user applications development	☒	☒	☒	☒

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PERFORMANCE TESTS: RELATIONAL DATABASES

FoxPro is best known for its blazing speed, and this strenuous series of tests only strengthens that reputation. Out of the 15 packages tested, **FoxPro** consistently finished among the top five, and usually among the top three.

HOW WE TESTED THE DATABASES

For our tests, we used 25-MHz Compaq Deskpro 386/25Es with 300MB hard disks and 4MB of extended RAM. Since database applications are I/O-intensive, we used high-performance Seagate hard disks with an average seek time of 17 milliseconds. Each hard disk was configured as a single 300MB partition under Compaq DOS 4.01, SHARE.EXE was loaded, and the CONFIG.SYS and AUTOEXEC.BAT files were supplied by the database vendors.

The PC Magazine Labs benchmark tests were adapted from the AS³AP (ANSI SQL Standard Scalable and Portable) Benchmark Tests for Relational Database Systems, developed by Carolyn Turbyfill, Cyril Orji, and Dina Bitton at Cornell University. These benchmark tests are a comprehensive set of queries written in ANSI SQL that tests the relational capabilities of database systems. (The AS³AP benchmark tests are in the public domain and can be obtained by contacting Dina Bitton at DB Software Corp., 220 California Ave., #201, Palo Alto, CA 94306.)

Experts representing each vendor provided us with routines that accomplished specified tasks in the benchmark test suite and assisted us throughout the evaluation process. Although the benchmark tests were written in SQL, the products were not required to support SQL. The objective was to achieve the same results as those produced by the SQL operation, using the method best suited to the product.

The vendors were permitted to use any expanded memory, disk caching, or RAM disk software that comes with their DBMS packages or operating environments. Compaq's DOS 4.01 includes RAMDISK.SYS and the Compaq expanded memory manager, CEMM.EXE. Products running under Microsoft Windows 3.0 used SMARTDRV.SYS, the Windows disk-caching utility, while Ashton-Tate used the proprietary disk cache, DBCACHE, which is shipped with dBASE IV.

TWO TEST DATABASES

We ran all of the tests on two databases: a medium-size database of 10,000 rows per table and a large database of 100,000 rows per table. Each database contained four tables of identical structure, but we varied the number of indexes in each table to see the effect on performance and to facilitate different queries. Actual data values and ranges also varied between tables but were

proportionate between databases. That is, if we searched through 1,000 rows on the 10,000-record database (or 10 percent of a table) to find a record, the same query on the 100,000-record database would search through 10,000 rows. Data types and ranges were typical for business applications. (The database structure and data ranges are shown in Figure 1.)

The average record length was 100 bytes per record, but this depended on the individual product's storage capabilities. For example, if the product did not support an integer data type but used a numeric character type instead, its storage requirements would have been 6 to 7 bytes greater than the corresponding integer. Thus, the product paid a penalty in additional storage. If a database manager did not support specified data types and

used less than 100 bytes, it imported an additional FILL field to make up the difference.

We required 13 indexes in each database—and our definition of "index" was flexible. We permitted the use of access methods, such as hashing or linked lists, even though they are not true indexes. (The tables and their indexes are listed in Figure 2.)

The vendors were instructed to build clustered indexes on the primary keys if the product supported clustering; otherwise they selected the type of indexes to use. Clustered indexes normally take longer to build than nonclustered indexes, since they arrange the data physically instead of just generating a set of record pointers. The clustered indexes also outperform non-clustered indexes, particularly when

Figure 1: Database Structure and Data Ranges

Field name	Data type	Data range/length
KEY*	Unsigned integer	0 to 1 billion
INT*	Unsigned integer	0 to 1 billion
SIGNED	Signed integer	-1 billion to 1 billion
FLOAT	Single-precision floating-point	-1.2 billion to 1.2 billion
DOUBLE	Double-precision floating-point	-1.2 billion to 1.2 billion
DECIM	Fixed decimal (0.00)	-1 billion to 1 billion
DATE	Date	1/1/1900 to 12/1/2000
CODE	Fixed character	10 alphanumeric characters
NAME	Fixed character	20 alphanumeric characters
ADDRESS	Variable character	2 to 80 alphanumeric characters
FILL	Fixed character	Varies, depending on product

* These two have the same data types but different values. KEY is an indexed field; INT is not.

Figure 2: Tables and Indexes

Table name	Indexed field name	Function	Unique values
UNIQUES	KEY	Primary key	Yes
	CODE	Alternate key	Yes
HUNDRED	KEY	Primary key	Yes
	CODE	Alternate key	Yes
TENPCT	KEY	Primary key	Yes
	CODE	Alternate key	Yes
	NAME		
	DECIM		
UPDATES	KEY	Primary key	Yes
	CODE	Alternate key	Yes
	INT		Yes
	DOUBLE		No
	DECIM		No

retrieving sequential records. This was certainly the case with our data, which was arranged in random order, and many of the queries retrieved ordered sets based on the key values.

Whenever possible, the tests were self-timed. Timing began at execution and ended just before control was returned to the keyboard. We did not time keystrokes or menu selections. Accuracy was within 2 seconds.

RELATIONAL OPERATIONS

We tested seven categories of relational operations:

LOADING AND INDEXING

OUTPUT

SELECTIONS

PROJECTIONS

JOINS

UPDATES

REPORT WRITING

With the exception of some Output tests, query results were sent to a print file.

The Loading and Indexing tests consumed the lion's share of the time. We originally planned a limit of 24 hours for loading and indexing the 100,000-record database, but after the first day of testing, the 24-hour time limit seemed unreasonable. The first products we tested, *DataEase* and *R:BASE*, took 22 hours and over 36 hours, respectively. As a practical matter, we had to set a time limit—one that the majority of products could meet—so, based on *R:BASE*'s performance, we set the limit at 40 hours.

We later discovered a recording error in the timing for *R:BASE*, which really took over 43 hours to load and index the 100,000-record database. Although it was too late to go back and retest *Omnis 5* and *Ramis*, the two products that were cut off at the 40-hour limit, we have included their results on the 10,000-record tests. We have published all the *R:BASE* results because we know that readers are interested in its performance on the entire test suite.

as you generate code through menu selections, the system makes it uniformly upper and lower case and indented, so maintenance is easy. Expect grumbling from the programming staff at first, but they should come around eventually.

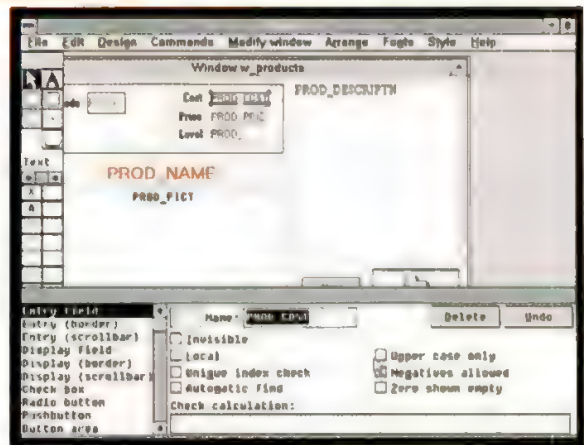
One very appealing feature of *Omnis 5* is the portability it offers between the Macintosh and PC worlds. If you have developed your application on a Mac and want to bring it over to DOS, simply copy the binary file to your PC and select Convert from the Application menu. Your application and data files, including bitmapped monochrome graphics, are quickly and automatically converted. If you have other graphics files, you need to convert them to .PCX format before you bring them in. Once you convert the application, you can run the software in your DOS environment, make modifications, and move it back to the Mac. Blyth Software is also developing versions that will run in OS/2 and Unix environments.

LAN SUPPORT

Omnis 5 supports Novell, LAN Manager, and TOPS operating systems, and gives you file and record locking with timeout/retry control, application encryption (not data), user and file protection (you can program record and field protection), and allows for restricted commands, and user-specific interfaces. The system supports a maximum of 451 concurrent users and provides access to *DB2*, *Microsoft SQL Server*, *Oracle Server*, and others from within the *Omnis 5* environment.

Omnis 5 is no speed demon, turning in below average times on the 10,000-record benchmark tests. It was one of the two packages that could not complete the loading and indexing of the 100,000-record database within our 40-hour time limit. When designing an application, you will want to establish all your indexes up front (up to 12) to avoid the hefty overhead of adding new indexes later on. Since *Omnis 5* stores all databases and indexes in one large file, overhead is created with each new index, which incrementally slows down the indexing process.

The flexible and easy-to-use report



When you click on a data field in the *Omnis 5* design window, you see the selected attributes of that field. *Omnis* is one of two Windows-based databases evaluated here.

generator and application generator, the on-line help, and the greatly improved documentation all assist the novice in quickly becoming productive with the package.

Omnis 5 offers a multiplatform solution to companies that want to establish a restricted yet homogeneous development environment between PCs and Macs. For applications of limited complexity and scope, *Omnis 5* has a lot to offer.

1 on 1 = 3 Integrated by Bruce Brown

Though *1 on 1 = 3 Integrated* hasn't changed much since its predecessor, *1 on 1 = 3!!*, Version 2.0 fixes some bugs and comes with two new applications modules. The package is still best used to help you learn *dBASE*-style programming, to develop *dBASE III Plus*-compatible program code, and to access *dBASE*-format data files without spending hundreds more for the real *dBASE*.

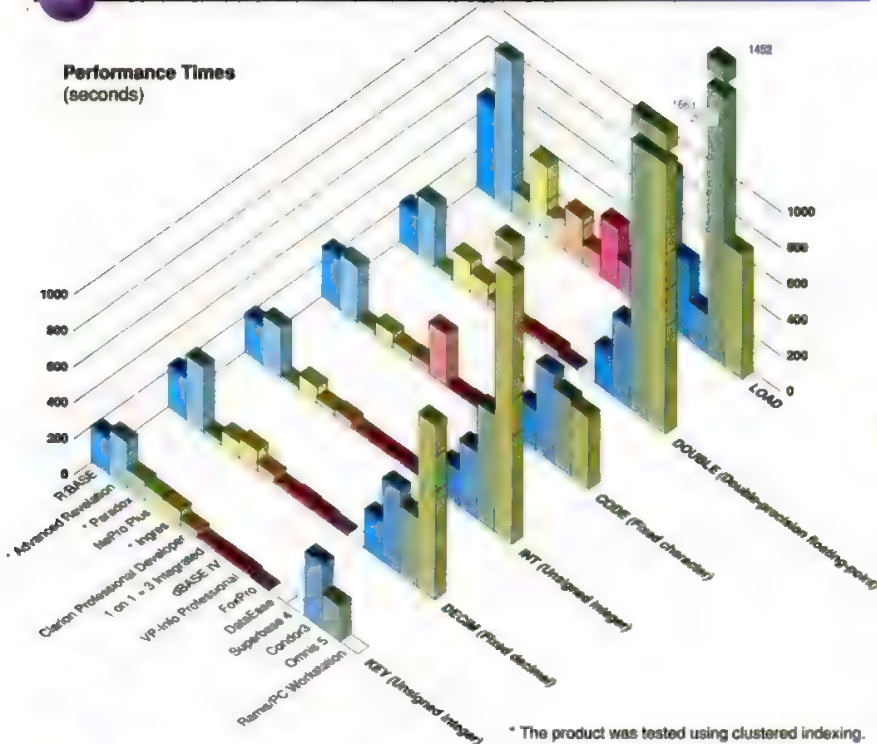
Published by 1 on 1 Computer Solutions and priced at \$99 (up from \$39 three years ago), this programmable relational database now includes a switching utility aptly called Switcher and versions of the *PC-Write* word processor and the *As-Easy-As* spreadsheet package, both very respectable shareware products. For \$189 you get *1 on 1 = 3*, Switcher, and fully licensed versions of *PC-Write* and *As-Easy-As*.



PERFORMANCE TESTS: RELATIONAL DATABASES

LOAD AND INDEX (10,000-record tables)

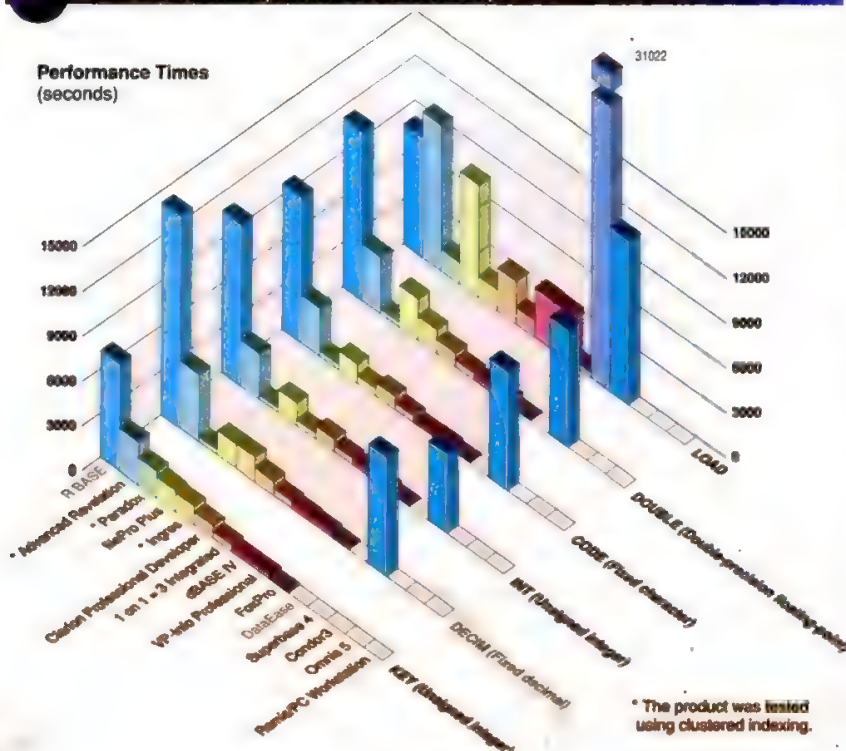
Performance Times
(seconds)



* The product was tested using clustered indexing.

LOAD AND INDEX (100,000-record tables)

Performance Times
(seconds)



* The product was tested using clustered indexing.

The Load and Index tests reveal great differences among the database packages we reviewed. Even when the packages shared a common file structure or indexing structure, the utilities for building those structures varied widely in performance. *FoxPro*, which uses *dBASE* files, took 48 minutes to load and index the 100,000-record database; *filePro Plus*, the slowest of the *dBASE* compatibles, took almost 14 hours.

All of the vendors used B-tree indexes, but even though they are among the most efficient indexing structures, some strategies for building B-trees proved woefully inefficient for large databases. *Omnis 5* and *Ramis/PC Workstation*, which could not complete loading and indexing the 100,000-record database within the 40-hour limit, place their indexes for a table in

LOAD AND INDEX (10,000-record tables)

	Index KEY (Unsigned integer)
R:BASE	00:03:22
* Advanced Revelation	00:04:16
* Paradox	00:01:47
filePro Plus	00:01:30
* Ingres	00:01:26
Clarion Professional Developer	00:00:44
1 on 1 = 3 Integrated	00:00:18
dBASE IV	00:00:21
VP-Info Professional	00:00:22
FoxPro	00:00:08
DataEase	N/A (a)
Superbase 4	N/A (a)
Condor3	00:06:01
Omnis 5	00:03:21
Ramis/PC Workstation	N/A (a)

LOAD AND INDEX (100,000-record tables)

	Index KEY (Unsigned integer)
R:BASE	01:59:48
* Advanced Revelation	00:47:34
* Paradox	00:29:24
filePro Plus	00:23:45
* Ingres	00:21:03
Clarion Professional Developer	00:14:44
1 on 1 = 3 Integrated	00:08:14
dBASE IV	00:04:57
VP-Info Professional	00:04:48
FoxPro	00:01:28
DataEase	N/A (a)
Superbase 4	N/A (a)
Condor3	N/A (b)
Omnis 5	N/A (c)
Ramis/PC Workstation	N/A (c)

(Shorter times represent better performance.)

one file. Adding or deleting indexes forces the software to rebuild the entire file; consequently, the amount of indexing time increases parabolically with each additional index.

Loading times listed for *Superbase 4*, *Ramis*, *DataEase*, and *Advanced Revelation* include some indexing times that could not be recorded independently. *Superbase 4* and *Ramis* automatically index the primary key field while loading, so these products do not show a separate time for building an index on the KEY field. *DataEase* can build indexes separately, but the recommended procedure is to build them while loading. We tried both methods and found that *DataEase* took 8 percent longer to build indexes after loading than to index and load simultaneously. *Advanced Revelation*

automatically hashes the key while loading, but a B-tree index was placed on the key as well. Only the additional B-tree time is shown for indexing KEY.

Advanced Revelation's hashing algorithm on the primary key determines the physical placement of the actual data. Indexes that sort the data rather than generate a set of pointers are called "clustered" indexes. These normally take longer to build than nonclustered indexes, but they are much faster at retrieving sequential data. The effect of clustering is particularly evident with *Paradox*. On the 100,000-record test, the clustered index on KEY took five times as long to build as the nonclustered index on INT. Besides *Paradox* and *Advanced Revelation*, *Ingres* was the only product tested that supports clustered indexes.

The **Load and Index** tests measure how quickly a database package loads and indexes a four-table database. They show how the number of indexes affects performance and how the program facilitates different data types.

All of the packages except *Condor3*, which required a fixed-length format, imported randomly ordered records from comma-delimited ASCII files. Indexes were built on the primary and alternate keys of all four tables, and two tables contained additional indexes on other fields. A total of 13 indexes were built. The graph shows results for only the UPDATES file, the table with the greatest number of indexes in our tests.

Elapsed Time (hours:minutes:seconds)

Index DECIM (Fixed decimal)	Index INT (Unsigned integer)	Index CODE (Fixed character)	Index DOUBLE (Double-precision floating-point)	Index TENPCT NAME (Fixed character)	Load UPDATES Table	Total Time to Load 4 Tables and Build 13 Indexes
00:03:56	00:03:36	00:04:41	00:03:40	00:00:48	00:08:29	01:16:32
00:06:04	00:04:39	00:05:09	00:05:37	00:05:40	00:13:57	02:04:18
00:00:25	00:00:19	00:00:24	00:00:21	00:00:33	00:02:13	00:20:15
00:01:28	00:01:31	00:01:19	00:02:47	00:01:38	00:06:32	00:46:08
00:01:56	00:00:32	00:00:41	00:01:56	00:01:02	00:02:18	00:24:58
00:00:49	00:00:43	00:00:48	00:00:48	00:01:01	00:04:08	00:26:35
00:00:20	00:00:19	00:04:50	00:00:21	00:06:40	00:01:56	00:37:09
00:00:28	00:00:19	00:00:12	00:00:26	00:00:12	00:05:40	00:26:26
00:00:21	00:00:21	00:00:20	00:00:33	00:00:31	00:02:52	00:16:58
00:00:10	00:00:09	00:00:10	00:00:10	00:00:11	00:00:36	00:04:32
N/A (a)	N/A (a)	N/A (a)	N/A (a)	N/A (a)	00:14:21	00:44:11
00:03:39	00:03:22	00:03:47	00:03:40	00:00:49	00:07:11	00:58:42
00:07:44	00:06:14	00:08:21	00:07:41	00:01:05	00:03:39	01:47:54
00:06:23	00:10:52	00:07:08	00:27:43	00:04:17	00:24:12	03:33:16
00:16:10	00:20:12	00:06:40	00:33:33	00:18:36	00:11:32	02:55:53

Elapsed Time (hours:minutes:seconds)

Index DECIM (Fixed decimal)	Index INT (Unsigned integer)	Index CODE (Fixed character)	Index DOUBLE (Double-precision floating-point)	Index TENPCT NAME (Fixed character)	Load UPDATES Table	Total Time to Load 4 Tables and Build 13 Indexes
03:56:22	02:59:19	02:42:17	03:06:48	04:39:11	02:12:40	43:44:40
01:15:29	00:50:46	00:53:46	01:02:46	01:01:00	02:40:58	23:51:31
00:05:49	00:05:18	00:06:16	00:05:44	00:10:13	00:24:26	04:40:45
00:27:21	00:25:41	00:21:04	00:46:28	00:26:05	02:04:37	13:44:55
00:27:16	00:06:38	00:08:52	00:27:10	00:13:53	00:23:59	05:01:03
00:15:48	00:14:43	00:15:41	00:15:59	00:14:49	00:48:16	06:37:30
00:08:46	00:08:16	00:08:23	00:08:46	00:10:21	00:19:34	03:15:07
00:05:47	00:04:59	00:03:22	00:05:41	00:02:43	00:56:18	04:42:07
00:04:40	00:04:48	00:04:18	00:08:11	00:07:03	00:55:17	04:50:35
00:01:46	00:01:28	00:01:29	00:01:34	00:01:56	00:06:41	00:48:14
N/A (a)	N/A (a)	N/A (a)	N/A (a)	N/A (a)	08:37:02	22:03:16
02:11:24	01:27:19	02:11:46	02:10:41	00:11:25	03:02:16	28:59:13
N/A (b)	N/A (b)	N/A (b)	N/A (b)	N/A (b)	N/A (b)	N/A (b)
N/A (c)	N/A (c)	N/A (c)	N/A (c)	N/A (c)	N/A (c)	N/A (c)
N/A (c)	N/A (c)	N/A (c)	N/A (c)	N/A (c)	N/A (c)	N/A (c)

N/A (a) — Not applicable: The time for building this index is included in the Load test.

N/A (b) — Not applicable: This product is limited to 65,000 records per table.

N/A (c) — Not applicable: This product did not complete the test within the allotted time.

* The product was tested using clustered indexing.

CONTINUES

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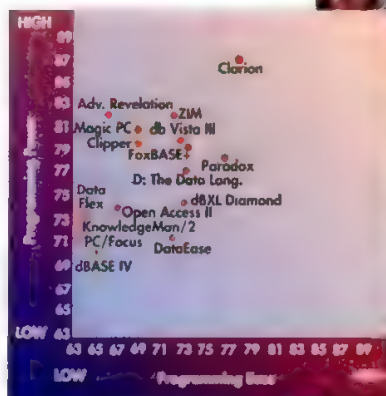
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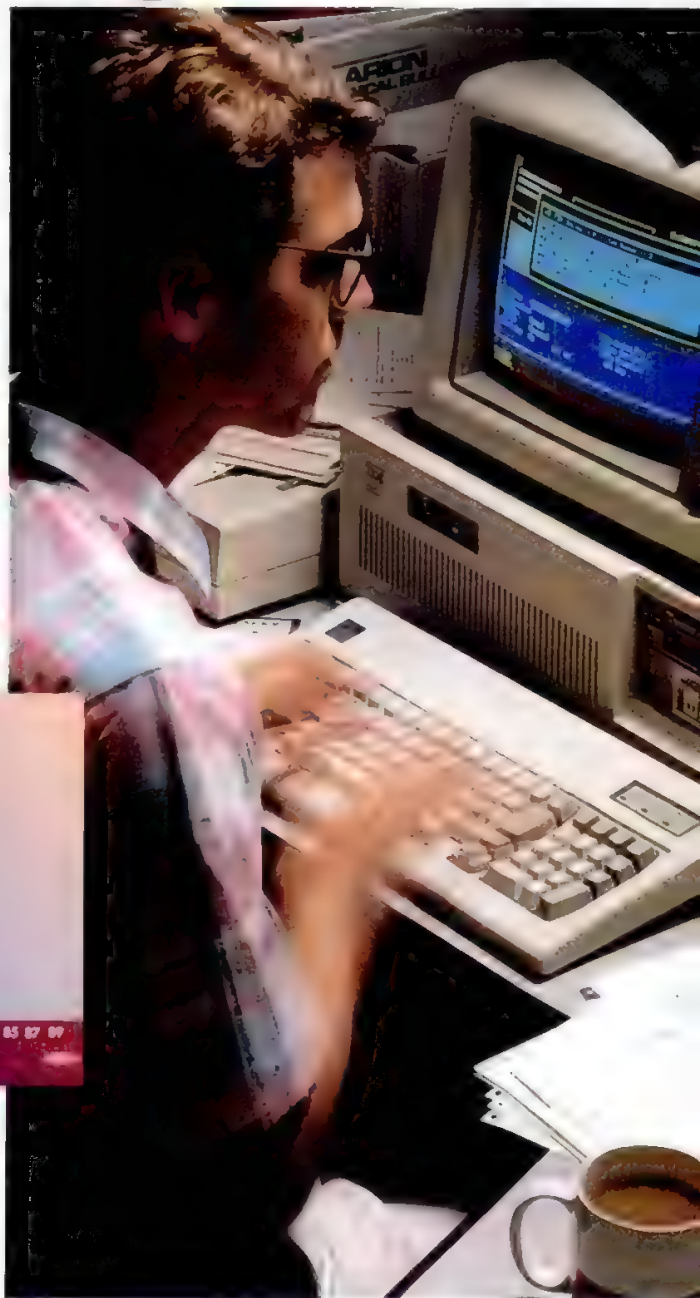
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PERFORMANCE TESTS: RELATIONAL DATABASES

FoxPro breezed through the Output Overhead testing, averaging about 9 seconds to output 1,000 records. *dBASE IV* was a close second, averaging about 12 seconds for all three forms of output. *Paradox* placed third overall, taking almost a minute to output 1,000 records to a print file (*Paradox* always writes the results of a query to an answer table regardless of the output mode).

Superbase 4 and *Omnis 5* are *Microsoft Windows*-based products, but not all of their overhead can be attributed to the graphical interface. *Superbase 4* was more than twice as fast as *Omnis 5* when printing or displaying data and five times as fast when writing to another database table.

Output overhead could not be determined for *Ingres* because of the way the self-timed programs were written. *Ingres* works very closely with DOS, and the vendor used DOS batch files with redirection to input queries and output the results. Timing began at the moment of query execution after *Ingres* was loaded but ended just before *Ingres* exited and passed the results back to DOS. Because of the additional overhead time involved in loading *Ingres* from the batch files, we could not accurately hand-time the queries.

The **Output Overhead** tests show how efficiently the database package operates in three output modes: to the screen, to a file, or to another table in the database. We measured overhead as the amount of data retrieved, selecting the first 1, 100, or 1,000 rows from tables in the 10,000-record database.

For simple selections, the time it takes to locate data is usually negligible compared with the time it takes to write the results of the query being performed. As the size of the result increases, so does the impact of output overhead on query execution time.

OUTPUT OVERHEAD (10,000-record table)

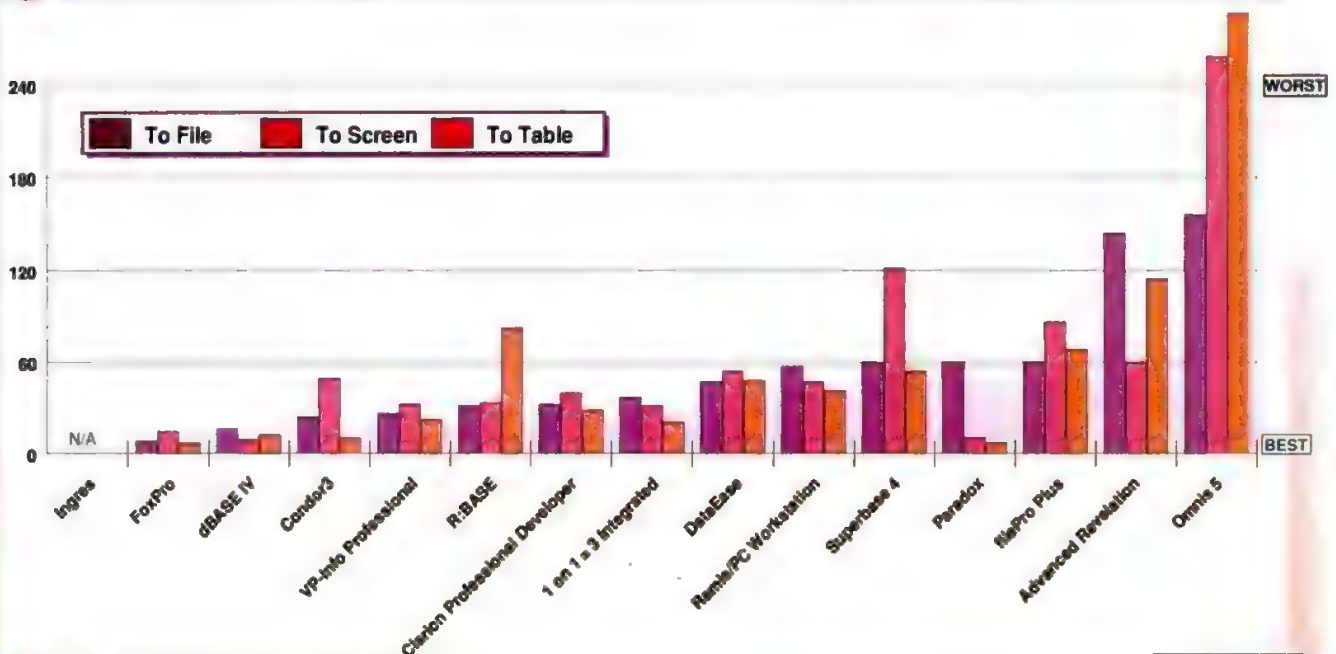
Elapsed Time (hours:minutes:seconds)

	To File	To Screen	To Table
<i>Ingres</i>	N/A	N/A	N/A
<i>FoxPro</i>	00:00:08	00:00:14	00:00:07
<i>dBASE IV</i>	00:00:16	00:00:09	00:00:12
<i>Condor3</i>	00:00:24	00:00:49	00:00:10
<i>VP-Info Professional</i>	00:00:26	00:00:32	00:00:22
<i>R:BASE</i>	00:00:31	00:00:33	00:01:22
<i>Clarion Professional Developer</i>	00:00:32	00:00:39	00:00:28
<i>1 on 1 = 3 Integrated</i>	00:00:36	00:00:31	00:00:20
<i>DataEase</i>	00:00:47	00:00:54	00:00:48
<i>Ramis/PC Workstation</i>	00:00:57	00:00:47	00:00:41
<i>Superbase 4</i>	00:00:59	00:02:01	00:00:54
<i>Paradox</i>	00:00:59	00:00:10	00:00:07
<i>filePro Plus</i>	00:01:00	00:01:26	00:01:08
<i>Advanced Revelation</i>	00:02:24	00:01:00	00:01:54
<i>Omnis 5</i>	00:02:36	00:04:19	00:04:47

(Shorter times represent better performance)
N/A—Not applicable. We could not determine *Ingres*'s overhead.

OUTPUT OVERHEAD (10,000-record table)

Elapsed Time (hours:minutes:seconds)



N/A—Not applicable. We could not determine *Ingres*'s overhead.

CONTINUES

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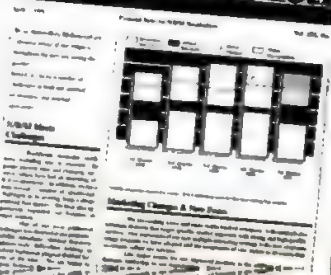
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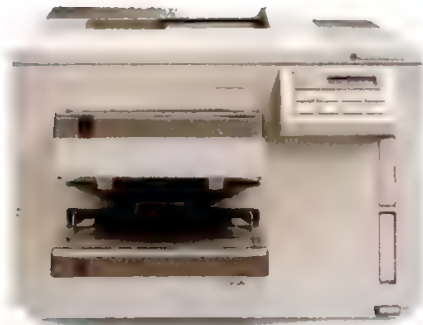
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PERFORMANCE TESTS: RELATIONAL DATABASES

We ran separate Select tests that retrieved a single record, 100 records, and 10 percent of the records in a table. Only the results of the 10 percent selections appear in the graphs.

All of the packages retrieved single-record selections on indexed fields in less than 1 second for the 10,000-record database and less than 4 seconds for the 100,000-record database. (Those results are not graphed here.) When compared with the time it takes to scan a database table, these figures testify to the efficiency of B-tree indexes. *Paradox*, one of the fastest scanning products, took almost a minute to read through the 100,000-record database searching for an unindexed value. *Advanced Revelation* had the slowest table-scanning time: 18 minutes.

In the 100-record selections, most of

the products retrieved and output the results in under 5 seconds for the 10,000-record database and in under 9 seconds for the 100,000-record database. *Omnis 5*, *Ramis/PC Workstation*, and *Advanced Revelation* were 4 to 5 seconds slower, and *R:BASE* was the slowest, taking 15 seconds to retrieve 100 records from the 10,000-record database and 2 minutes 14 seconds with the 100,000-record database.

On the 10 percent selections shown here, the query on the numeric field KEY took longer to process than the query on NAME for all of the products except *Paradox*, *Ingres*, and *Advanced Revelation*, which have clustered indexes. This is because the KEY field contained unique values, whereas NAME did not. Ten names were repeated 1,000 times in the 10,000-record database and 10,000

times in the 100,000-record database. Since there were considerably fewer entries to search, selections from the alpha index were generally faster than from the numeric. For products with clustered indexes, however, the reverse was true. The performance advantage of clustering greatly outweighed the disadvantage of searching through an exceptionally large index.

Queries used in test:

numeric:

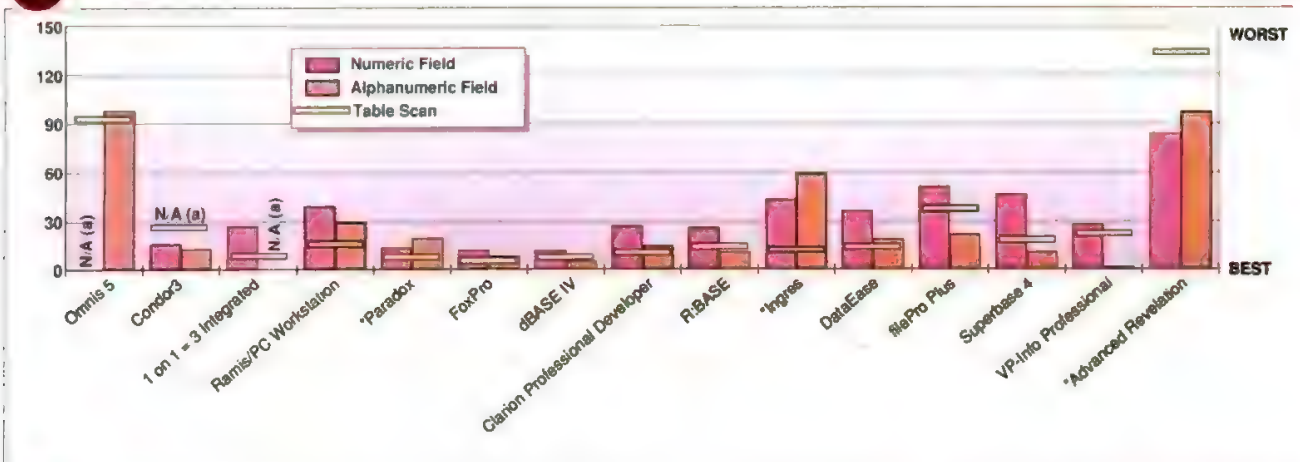
```
SELECT KEY, INT, SIGNED, CODE,
DOUBLE, NAME FROM UNIQES WHERE
KEY <= 100000000
```

alphanumeric:

```
SELECT KEY, INT, SIGNED, CODE,
DOUBLE, NAME FROM TENPCTWHERE
NAME = 'THE+ASAP+BENCHMARKS+'
```

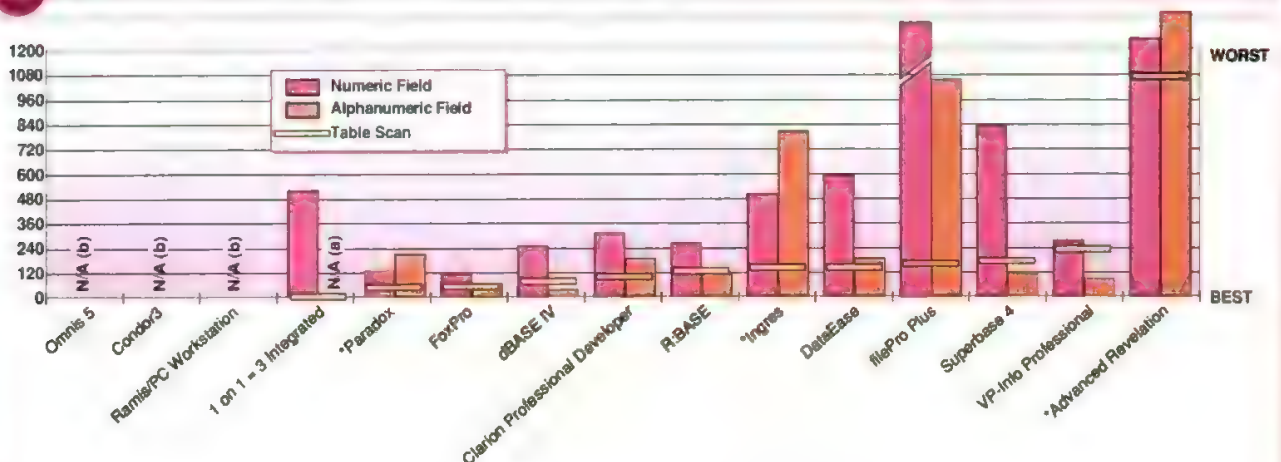
SELECT (10,000-record table)

Elapsed Time (seconds)



SELECT (100,000-record table)

Elapsed Time (seconds)



For the **Select** tests, we first determined the amount of time required to scan the entire table. Then we timed how long it took each package to select records based on indexed fields of two different data types: numeric and alphanumeric.

These tests measure the impact of storage organization on record retrieval. The queries also show the performance difference between clustered and nonclustered indexes, since a clustered index was re-

quired on the primary (numeric) key.

Selection speed also depends on the number of records selected. We varied the selectivity of the queries to retrieve 1 record, 100 records, and 10 percent of the records in a table. The graph depicts the elapsed query time for the 10 percent selection on the primary key index versus a secondary alphanumeric index. The total time to scan the table is shown for comparison.

SELECT (10,000-record table)

Elapsed Time (hours:minutes:seconds)

	Numeric Field	Alphanumeric Field	Table Scan
Omnis 5	N/A (a)	00:01:38	00:01:34
Condor3	00:00:16	00:00:13	N/A (a)
1 on 1 = 3 Integrated	00:00:27	N/A (a)	00:00:09
Ramis/PC Workstation	00:00:39	00:00:29	00:00:17
* Paradox	00:00:14	00:00:20	00:00:08
FoxPro	00:00:12	00:00:08	00:00:06
dBASE IV	00:00:12	00:00:05	00:00:08
Clarion Professional Developer	00:00:27	00:00:15	00:00:11
R:BASE	00:00:28	00:00:11	00:00:15
* Ingres	00:00:43	00:00:59	00:00:13
DataEase	00:00:36	00:00:19	00:00:15
filePro Plus	00:00:51	00:00:22	00:00:38
Superbase 4	00:00:46	00:00:11	00:00:19
VP-Info Professional	00:00:28	00:00:01	00:00:23
* Advanced Revelation	00:01:24	00:01:37	00:02:14

SELECT (100,000-record table)

Elapsed Time (hours:minutes:seconds)

	Numeric Field	Alphanumeric Field	Table Scan
Omnis 5	N/A (b)	N/A (b)	N/A (b)
Condor3	N/A (b)	N/A (b)	N/A (b)
Ramis/PC Workstation	N/A (b)	N/A (b)	N/A (b)
1 on 1 = 3 Integrated	00:08:44	N/A (a)	00:00:16
* Paradox	00:02:14	00:03:33	00:00:53
FoxPro	00:01:58	00:01:08	00:00:59
dBASE IV	00:04:12	00:00:38	00:01:21
Clarion Professional Developer	00:05:11	00:03:11	00:01:43
R:BASE	00:04:26	00:01:55	00:02:12
* Ingres	00:08:23	00:13:26	00:02:23
DataEase	00:09:56	00:03:07	00:02:26
filePro Plus	00:36:32	00:17:37	00:02:44
Superbase 4	00:13:50	00:01:49	00:03:04
VP-Info Professional	00:04:35	00:01:31	00:03:54
* Advanced Revelation	00:20:54	00:23:01	00:17:54

(Shorter times represent better performance.)

* The product was tested using clustered indexing on the numeric field

N/A (a)—Not applicable. Because of coding errors, we were not able to obtain a valid result

N/A (b)—Not applicable. The product was not tested

CHOOSE YOUR MODE

The opening menu in *1 on 1 = 3* displays a simple black and white vertical layout with six choices: Menu Mode, Command Mode, Administration, XDOS, Documentation, and Quit. You can activate these commands by pressing a single key corresponding to the first letter of your choice, or by scrolling with the cursor and selecting with the Enter key. Choose Command Mode, and a single command line appears on the bottom of the screen where you enter dBASE-compatible commands.

In Menu Mode, *1 on 1 = 3* uses a limited color screen—though it's still in strict text mode—with a more modern interface than in the opening menu. There's a top-line horizontal menu for major functional choices, pull-down option menus, and a 12-line context-sensitive help win-

SUITABILITY TO TASK

1 on 1 = 3 Integrated

Data loading and access	☒	☒	☒	☐
On-line inquiry	☒	☒	☐	☐
Ad hoc reporting	☒	☒	☐	☐
Professional applications development	☒	☐	☐	☐
End-user applications development	☒	☒	☒	☐

dow with user prompts and explanations of features along the bottom of the screen. The F1 key provides more complete help information and is available at anytime. The superlative help system also includes a help topic index.

The Administration choice lets you select monochrome or color screens and set the system rights to read-only or update, which allows changes. Select Documentation to print the topic index or selected pages of information from the on-line help system. XDOS brings up an alternative command processor in which you can enter DOS commands and then return to the menu you were in by typing Exit at the DOS prompt.

FOXBASE ORIGINS

The most unique aspect of *1 on 1 = 3* is its origin. The package is a runtime application developed in *FoxBase 2.1* and therefore has many of the same specifications that are in *FoxBase 2.1*, such as number of fields and number of records. In suc-

CONTINUES



PERFORMANCE TESTS: RELATIONAL DATABASES

Like the Load and Index tests, the Project test produced a wide range of results. Since we projected an unindexed field, the operation called for sorting the data and then eliminating duplicates. The *dBASE*-compatible programs with fast indexing utilities generated indexes on the fly and copied the projected field to a text file. As

usual, *FoxPro* led the pack, completing the 10,000-record projection in just 18 seconds. *Paradox*, which placed second, used a query optimizer that determines the best strategy for each query. *Clarion Professional Developer*, *Advanced Revelation*, and *DataEase*, which used sort utilities, were generally the slowest performers on

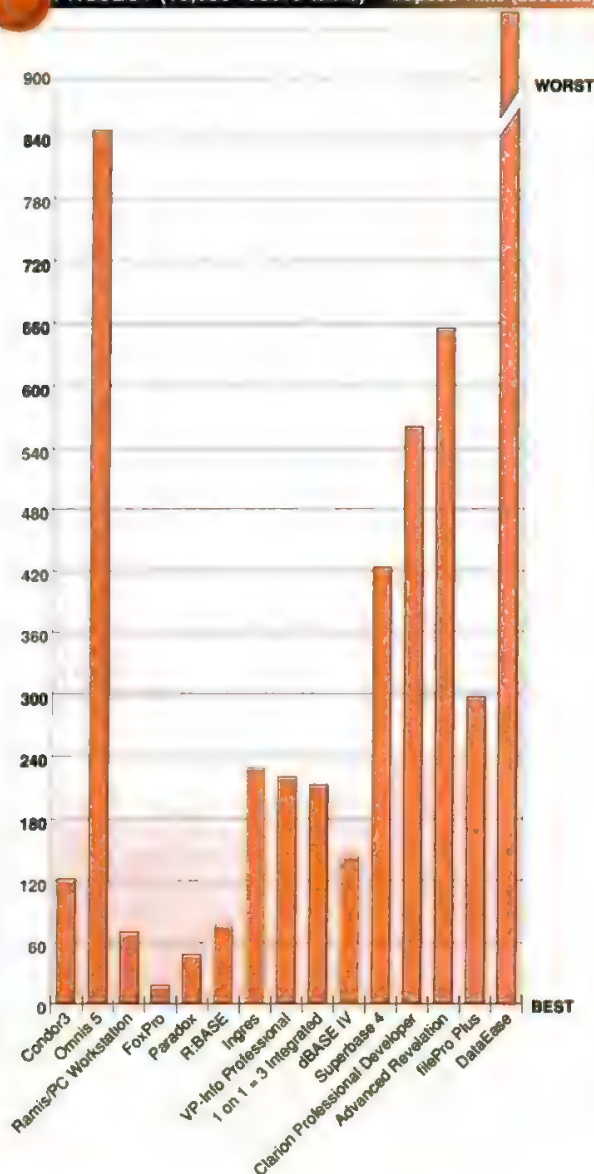
both the small and large databases.

Ramis PC/Workstation finished third on the 10,000-record projection. In the light of its performance on other tests, the 70-second time seems very unusual. *R:BASE* also did very well, completing the 100,000-record projection in roughly 14 minutes.

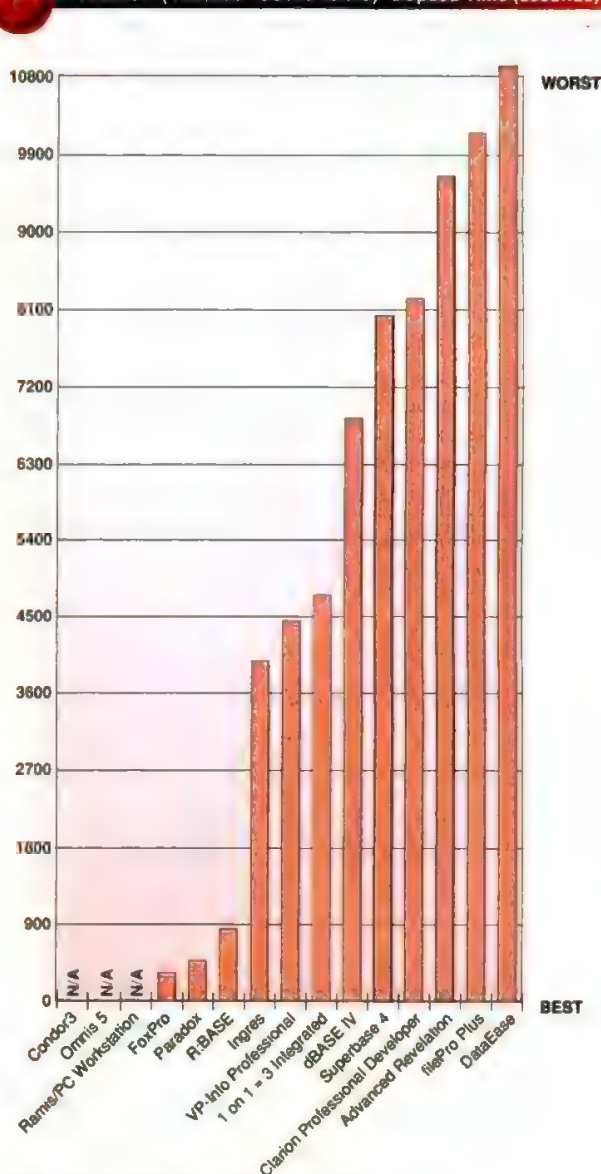
Query used in test:

SELECT DISTINCT SIGNED FROM
UNIQUES ORDER BY SIGNED

PROJECT (10,000-record table) Elapsed Time (seconds)



PROJECT (100,000-record table) Elapsed Time (seconds)



N/A—Not applicable: The product was not tested.

COVER STORY

RELATIONAL DATABASES

The **Project** test measures how long it takes to sort and output a single column from the UNiques table, one of the four tables used in testing. Projections extract a subset of fields from one table, and because of the additional overhead incurred in eliminating duplicates, they normally take longer to process than selections.

PROJECT (10,000-record table)	
Elapsed Time (hours:minutes:seconds)	
	Project
Condor3	00:02:02
Omnis 5	00:14:06
Ramis/PC Workstation	00:01:10
FoxPro	00:00:18
Paradox	00:00:48
R:BASE	00:01:18
Ingres	00:03:49
VP-Info Professional	00:03:40
1 on 1 = 3 Integrated	00:03:32
dBASE IV	00:02:25
Superbase 4	00:07:03
Clarion Professional Developer	00:09:20
Advanced Revelation	00:10:55
filePro Plus	00:04:57
DataEase	01:01:59

PROJECT (100,000-record table)	
Elapsed Time (hours:minutes:seconds)	
	Project
Condor3	N/A
Omnis 5	N/A
Ramis/PC Workstation	N/A
FoxPro	00:05:38
Paradox	00:07:59
R:BASE	00:14:17
Ingres	01:06:08
VP-Info Professional	01:14:09
1 on 1 = 3 Integrated	01:19:25
dBASE IV	01:53:59
Superbase 4	02:13:50
Clarion Professional Developer	02:17:08
Advanced Revelation	02:40:48
filePro Plus	02:49:13
DataEase	03:02:11

(Shorter times represent better performance.)

N/A—Not applicable: The product was not tested.

CONTINUES

ceeding versions of *FoxBase*, Fox Software changed its licensing procedures for distribution of runtime applications like *1 on 1 = 3*. Thus, 1 on 1 Computer Solutions cannot rewrite the program for compatibility with later versions of *FoxBase*.

1 on 1 = 3 is a *dBASE* twin with several features that improve on *dBASE III Plus*, although it doesn't include features new to *dBASE IV*. The menu system in *1 on 1 = 3* is very easy to use and includes full-menu prompts for smooth interaction during every step of organizing, editing, and searching for data. Since you can read *dBASE* data files and run or edit *dBASE III Plus* program files, you aren't isolated with *1 on 1 = 3*.

On the contrary, you can access or share data and program files created by *dBASE III Plus* or any of the many other programs that create *dBASE*-compatible code. *1 on 1 = 3* also has a macro feature that you can use to record frequently used keystroke sequences as a convenient time-saver.

You'll find that running *1 on 1 = 3* in

interactive mode (without programming) is faster than using regular *dBASE III Plus*. Running programmed applications created in *1 on 1 = 3* takes longer in general than running *dBASE*-created programs since any program code you create is actually done in *FoxBase*, while *dBASE*



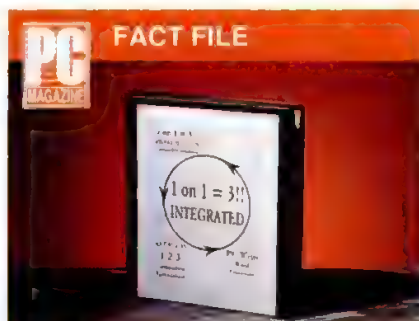
1 on 1 = 3's Interactive Menu Mode walks you through every step in most of the package's functions. It uses a variety of horizontal function menus, pull-down and pop-up menus, as well as a user prompt screen.

is a faster C-based development language. When *1 on 1 = 3* programs are just running simple interactive statements, such as multiple common queries, the times are still better than with *dBASE III Plus*, but more complicated processes take longer.

Thanks largely to its *FoxBase* origin, *1 on 1 = 3* shows very good times on most of the benchmark tests. Indexing is particularly fast, especially on smaller files, since the time *1 on 1 = 3* takes to build indexes increases with the size of indexes. The package was second (behind *FoxPro*) in loading 100,000 records, and its joins were also respectably fast.

LEARNING dBASE

1 on 1 = 3 is a relative bargain, but it's quite limited when it comes to customer support. If Frank Rogers, the programmer, owner, publisher, and sole technical support person is busy, there's no one else for you to talk to. You wouldn't be entirely stranded, however, since the program code and data files you work with in *1 on 1 = 3* are *dBASE*-compatible, so



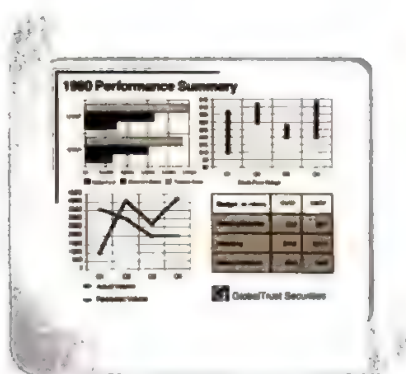
1 on 1 = 3 Integrated, Version 2.0

1 on 1 Computer Solutions Inc., 26 Finchwood Dr., Trumbull, CT 06611; 203-375-0914.

List Price: \$99, including Switcher, As-Easy-As, and PC-Write; \$189, including Switcher and full rights to As-Easy-As and PC-Write.

Requires: 640K RAM, DOS 2.0 or later.
In Short: *1 on 1 = 3* mimics and improves on *dBASE* while maintaining *dBASE* compatibility. It's easier to use and faster than *dBASE* in interactive functions, but generally slower when running programs. User support is the weakest area with this one-person company, but for the money you get a good deal of power.

CIRCLE 417 ON READER SERVICE CARD



Additions to Marketing Department

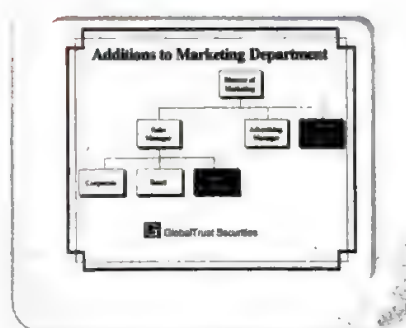
- Sales and advertising managers haven't changed from prior department structure
- Promotion spot has yet to be filled
- Sales manager is in process of making assignments
- Market development person starts next month
- Organizational changes are effective January 1

GlobalTrust Securities



National Sales Meeting Notes

GlobalTrust Securities



Bond Trading Seminars

- Targeted at new accounts in Europe and Asia

Financial Planning Direct Mail

- Directed at customer base
- Focused on retirement strategies

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CIRCLE 195 ON READER SERVICE CARD



PERFORMANCE TESTS: RELATIONAL DATABASES

In one-to-one joins between two, three, and four tables, almost all of the products returned the results in under 2 seconds with each database. (These results are not graphed here.) *Ramis/PC Workstation* and *dBASE IV* were the only notable exceptions. *Ramis* took about 3.5 minutes for each of the joins in the 10,000-record tables, favoring joins on the alphanumeric CODE field by about 20 seconds. *dBASE IV* took between 12 and 42 seconds to join the 10,000-record tables and between 2 and 9 minutes to join the 100,000-record tables. Strangely, *dBASE IV* did best on the four-table joins and worst on the three-table joins. For the 100,000-record database, *dBASE IV* took 1 minute 54 seconds for the

four-table join on CODE and 9 minutes 10 seconds for the three-table join on KEY. Since *dBASE IV* does not have a query optimizer, the person programming the query must decide how to join each table.

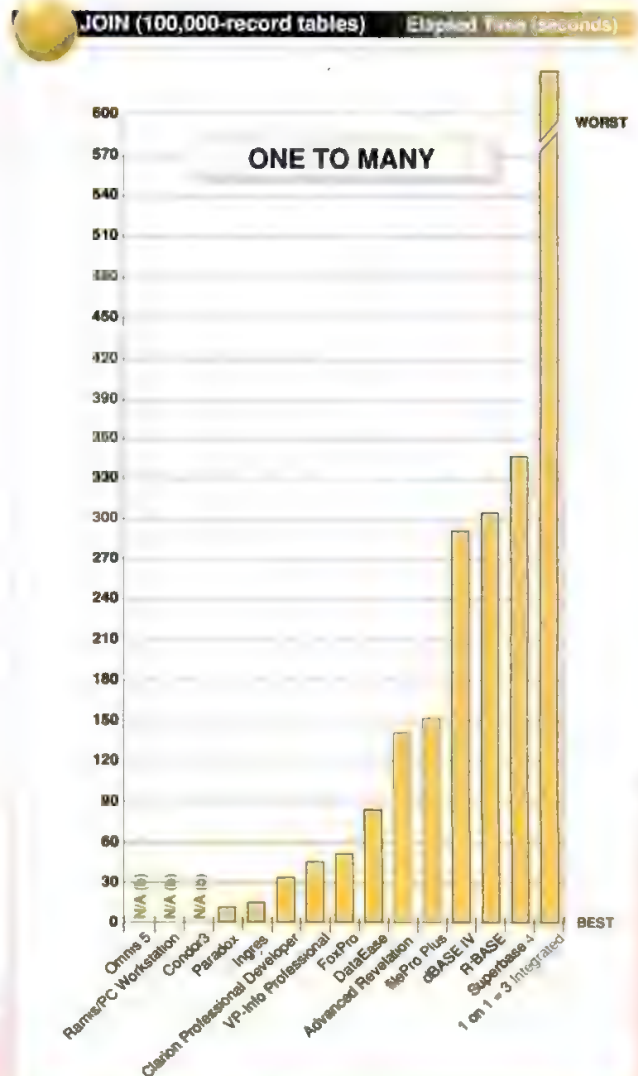
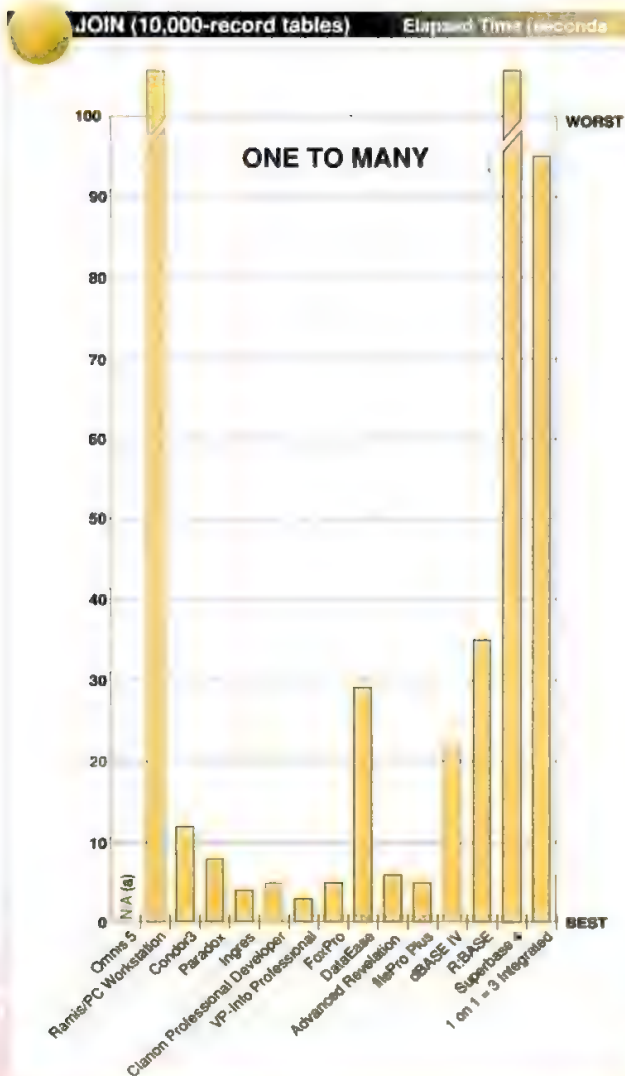
The one-to-many join between two tables, which we show here, had significantly different results. The query we used for this test was a range join designed to confuse query optimizers. Results on the 10,000-record database ranged from 3 seconds for *VP-Info Professional* to more than 4 minutes for *Ramis/PC Workstation* and 6 minutes for *Superbase 4*. *Ramis* and *Superbase 4* both have query optimizers.

On the 100,000-record database, *Paradox* completed the query in just 12

seconds. Apparently, *Paradox's* heuristic query optimizer was not fooled. On the other end of the scale, *1 on 1 = 3 Integrated* took nearly 38 minutes, an exceptionally poor result for a package that performed very well on all the other tests. *1 on 1* was written in *FoxBase*; like other *dBASE* compatibles, it does not have a query optimizer.

Query used in test:

```
SELECT UNIQUES.KEY, UNIQUES.NAME,
TENPCT.KEY, TENPCT.SIGNED FROM
UNIQUES, TENPCT WHERE UNIQUES.KEY
>= 1000000000 AND (TENPCT.KEY <=
UNIQUES.KEY AND TENPCT.KEY >
990000000)
```



N/A (a)—Not applicable: Because of coding errors, we were not able to obtain a valid result.
N/A (b)—Not applicable: The product was not tested.

The Join tests show how query complexity affects database performance. We ran two groups of Join tests; only the one-to-many join test is graphed here. This test joins one record from one table to 1 percent of the records in another table, using indexed values.

JOIN (10,000-record tables)

Elapsed Time (hours:minutes:seconds)

One to Many

Omnis 5	N/A (a)
Ramis/PC Workstation	00:04:16
Condor3	00:00:12
Paradox	00:00:08
Ingres	00:00:04
Clarion Professional Developer	00:00:05
VP-Info Professional	00:00:03
FoxPro	00:00:05
DataEase	00:00:29
Advanced Revelation	00:00:06
filePro Plus	00:00:05
dBASE IV	00:00:22
R:BASE	00:00:35
Superbase 4	00:06:02
1 on 1 = 3 Integrated	00:01:35

Elapsed Time (hours:minutes:seconds)

One to Many

Omnis 5	N/A (b)
Ramis/PC Workstation	N/A (b)
Condor3	N/A (b)
Paradox	00:00:12
Ingres	00:00:15
Clarion Professional Developer	00:00:34
VP-Info Professional	00:00:46
FoxPro	00:00:52
DataEase	00:01:24
Advanced Revelation	00:02:21
filePro Plus	00:02:32
dBASE IV	00:04:51
R:BASE	00:05:05
Superbase 4	00:05:47
1 on 1 = 3 Integrated	00:37:56

(Shorter times represent better performance)

N/A (a)—Not applicable. Because of coding errors, we were not able to obtain a valid result.
N/A (b)—Not applicable. The product was not tested.

CONTINUES

you can always turn to the dozens of dBASE books available to the world.

1 on 1 = 3 is a good programmable relational database system that's clearly basic. It doesn't have an intuitive interface like Paradox, it lacks the power for highly sophisticated applications development, and it lacks the query and security features found in high-end packages like DataEase. And since 1 on 1 = 3 is anchored to the earlier Version 2.1 of FoxBase, further development is limited unless the program is rewritten in another language.

1 on 1 = 3 is not recommended for large corporate or even medium-size applications, at least not when used by itself. It can be a real money saver, though, when purchased for end users in a company where real development is done in dBASE or a more-powerful dBASE-compatible package. 1 on 1 = 3 is definitely for people who want to learn about programming with a relational database package and for those who need a dBASE III Plus clone to access existing files and programs.

Paradox

by Alfred Poor

When Paradox first appeared in 1985, it represented a new approach to database management on a PC. Now a product of Borland International, the \$795 Version 3.5 continues to provide a fresh and powerful way to handle data. "The thinking user's DBMS," Paradox is still one of those rare programs that appeals to beginners and to power users alike.

Credit for at least part of Paradox's success has to be given to its way of envisioning database tasks. Rather than start with the traditional view of individual fields and records as typified by dBASE and its work-alikes, Paradox designers came up with a view they felt could be more easily understood. The program uses "tables" instead of files or relations, and these are displayed on-screen in rows and columns, much like a spreadsheet database range in Lotus 1-2-3.

The similarity does not stop there, however. When you issue a query, the records that meet the selection criteria "drop down" to the bottom of the screen to create a temporary table named "ANSWER." You can then use this table

as the source of information for reports or save it under a new name and perform additional operations on it.

The query operation is as visual and straightforward as the rest of Paradox. Using its own version of "Query by

SUITABILITY TO TASK

Paradox

Data loading and access	   
On-line inquiry	   
Ad hoc reporting	   
Professional applications development	   
End-user applications development	   

Example," the program lets you enter conditional statements in a table's columns to define selection criteria. Check marks in the columns indicate which fields are to appear in the results. You can even define calculations involving fields and constants to create new fields on-the-fly.

And if you need to link two or more tables, Paradox really shines—simply place matching values in the columns you want matched, and the program does the rest. There is no need for complex programming, predefined relations, or complicated indexing of fields in advance.

PAINLESS AT ALL SKILL LEVELS

Borland wants users of all skill levels to be able to get information out of a Paradox database quickly and painlessly. And since the answers appear in a new table, there is no risk of altering the original data. The same query process allows you to perform mass updates and deletes, but keeping safety in mind, Paradox keeps original copies of all modified or deleted records in a temporary table so you can reverse the changes quickly in the event that your query does something you did not anticipate.

You also get easy access to a variety of sophisticated features for data entry, such as range checking, look-up validation with other tables, and data pictures for entry formatting.

If you do not want to look at the tables of data, you can create data-entry forms. This feature is much improved over earlier versions of the program, and now you can even create forms that show records



PERFORMANCE TESTS: RELATIONAL DATABASES

All of the products performed single-record updates in under 2 seconds, regardless of the status of secondary indexes (these test results are not charted). All of the vendors placed B-tree indexes on the key, so whether we updated single records in the middle or the end of the file made no difference.

The bulk updates, which we show here, yielded different results. We modified 1,000 records by subtracting 100,000 from the value of each key. We then inserted 1,000 new records into the original key range and deleted the modified records. Indexes were either active or updated after each operation.

Most of the products showed a pronounced time difference for each operation, but modifying the key usually took less time than the other updates. Except in the case of *Condor3* and *Advanced Revelation*, which generate and delete temporary records, key modifications alter only one field. They also require updating only the index. The other operations insert or delete entire records, substantially modifying both the table and the index.

For the **Update** tests we inserted, modified, and deleted records with different indexes turned on to determine the effect of indexing overhead. We performed bulk updates on 1,000 records in the middle of the key range, and single-record updates on records at the beginning, middle, and end of the key range. The bulk updates were performed on the 10,000-record database only.

UPDATE (10,000-record table)

Elapsed Time (hours:minutes:seconds)

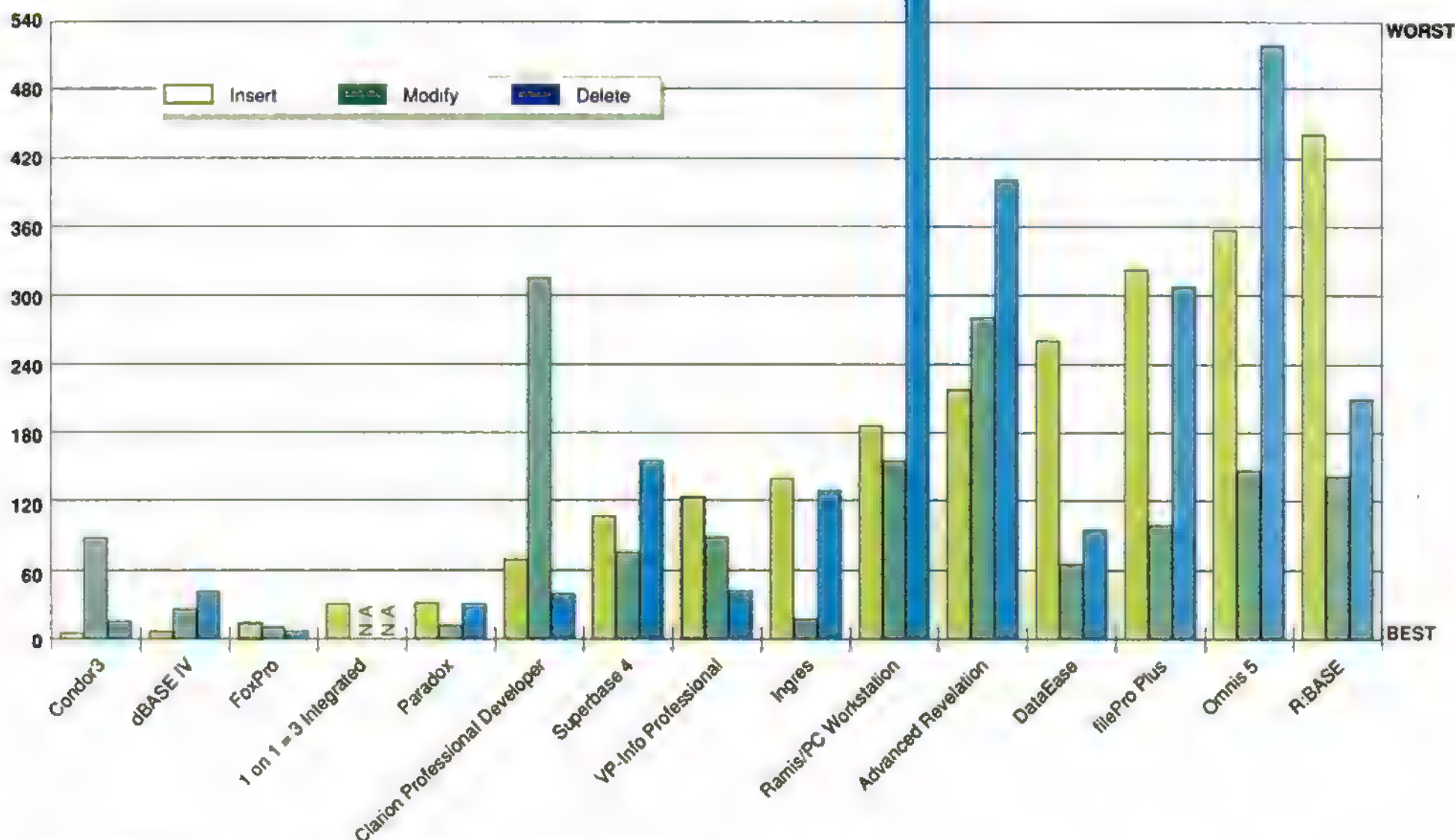
	Insert	Modify	Delete
Condor3	00:00:06	00:01:28	00:00:15
dBASE IV	00:00:07	00:00:26	00:00:41
FoxPro	00:00:14	00:00:10	00:00:07
1 on 1 = 3 Integrated	00:00:30	N/A	N/A
Paradox	00:00:31	00:00:12	00:00:30
Clarion Professional Developer	00:01:09	00:05:15	00:00:39
Superbase 4	00:01:47	00:01:15	00:02:34
VP-Info Professional	00:02:03	00:01:29	00:00:42
Ingres	00:02:19	00:00:17	00:02:09
Ramis/PC Workstation	00:03:06	00:02:34	00:09:36
Advanced Revelation	00:03:37	00:04:41	00:06:41
DataEase	00:04:20	00:01:05	00:01:35
filePro Plus	00:05:23	00:01:39	00:05:08
Omnis 5	00:05:57	00:02:26	00:08:39
R:BASE	00:07:20	00:02:21	00:03:29

(Shorter times represent better performance.)

N/A—Not applicable: Because of coding errors, we were not able to obtain a valid result.

UPDATE (10,000-record table)

Elapsed Time (seconds)



N/A—Not applicable: Because of coding errors, we were not able to obtain a valid result.

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deepest
secret
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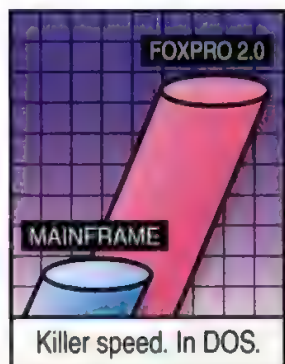
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FoxPro 2.0 gives you the ease-of-use of a Graphic User Interface on your character-based DOS PC.

Use pull-down menus to open multiple windows (in DOS) and see all the data you need to see at once. Build easy-to-use screens for entering and viewing data just by picking-and-clicking to place menus, buttons, checkboxes and scrolling lists anywhere you want them. Create sophisticated, elegant reports without the usual pain. Then assemble

that acts like a Mac and In DOS.



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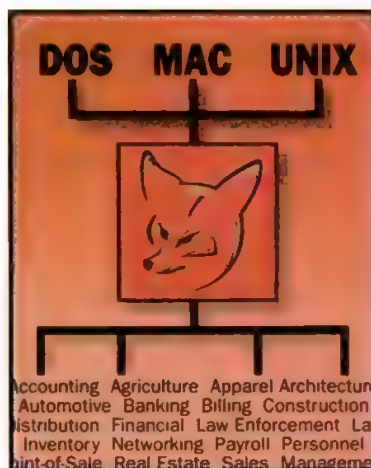
Our new compound indexes are less than a quarter the size of those in competitive products and far, far faster.

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† Patent applied for. ‡ A PC and FoxPro beat a mainframe and DB2 with a million-record, 200 megabyte database! * Quote from Software Digest Ratings Report, Vol. 7, Issue 13 (Oct 1990) refers to FoxPro 1.02. Software Digest is a registered trademark of NSTL, Inc. Upgrade price valid only in U.S.A. and Canada. FoxPro TM Fox Holdings Inc. © Fox Holdings Inc. 1991.



PERFORMANCE TESTS: RELATIONAL DATABASES

Only five of the products we tested were capable of producing the test report with end-user tools. The report was designed to test the power and flexibility of these ad hoc report writers, but we were surprised by the small percentage of fully functional report generators.

Advanced Revelation has five report writers, including an ANSI SQL processor, but none of them included the range of functions required in our test. The package's SQL processor could not produce the report because ANSI SQL does not support a combination of subtotals and totals in the same query. Users usually expect this capability in a report generator, and most products provide it.

The aggregate functions, particularly COUNT DISTINCT, were what excluded several other packages, including *FoxPro* and *dBASE IV*. *DataEase* does not directly support COUNT DISTINCT, but its ability to accumulate values in variables lets it produce the same results.

Condor3, *DataEase*, and *Paradox* showed remarkable speed in their ad hoc report writers, taking about 10 seconds to select, format, and print the final report. *Condor3* and *DataEase* had report writers that matched their programmed counterparts in speed, but *Paradox* and *R:BASE* had end-user tools that outperformed their own programming languages.

The two **Report** tests were performed on the 10,000-record database. Both tests produced the same report, first using the package's programming language, and second using the package's end-user report writers.

For these tests, a view was created by joining two tables. Then 100 records were selected for a summary report, reproduced in part here. The report included calculations on numeric and date values, break fields with subtotals, customized output formats, headers and footers, and pagination.

Query used in test:

```
SELECT AVG(SIGNED), MIN(SIGNED),
MAX(SIGNED), MAX(DATE), MIN(DATE),
COUNT(DISTINCT NAME), COUNT(CODE),
SUM(DOUBLE) FROM REPORTVIEW WHERE
DECIM > 980000000 GROUP BY NAME
```

REPORT (10,000-record view)

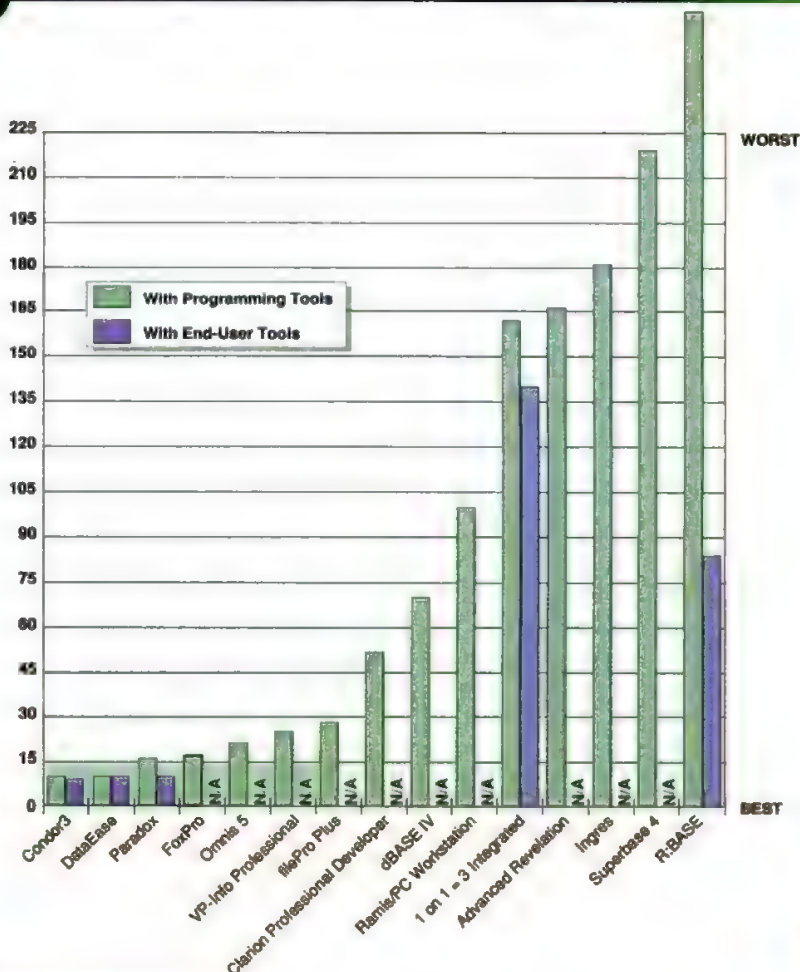
Elapsed Time (hours:minutes:seconds)

	Report Generated with Programming Tools	Report Generated with End-User Tools
Condor3	00:00:10	00:00:09
DataEase	00:00:10	00:00:10
Paradox	00:00:16	00:00:10
FoxPro	00:00:17	N/A
Omnis 5	00:00:21	N/A
VP-Info Professional	00:00:25	N/A
filePro Plus	00:00:28	N/A
Clarion Professional Developer	00:00:52	N/A
dBASE IV	00:01:10	N/A
Ramis/PC Workstation	00:01:40	N/A
1 on 1 = 3 Integrated	00:02:42	00:02:20
Advanced Revelation	00:02:46	N/A
Ingres	00:03:01	N/A
Superbase 4	00:03:39	N/A
R:BASE	00:04:25	00:01:24

(Shorter times represent better performance.)
N/A—Not applicable: The product could not generate this report with end-user tools.

REPORT (10,000-record view)

Elapsed Time (seconds)



ENDS



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CIRCLE 250 ON READER SERVICE CARD

COVER STORY

RELATIONAL DATABASES

Viewing Answer table: Record 1 of 10

FORM	Last	First	Id	State
1	Houghton	Robert	9160005	VA
2	Hartwig	Sonatha	9674006	WV
3	Hinichy	Courtney	4060770	PA
4	Horch	Jennifer	3577504	GA
5	Hain	Elizabeth	4544000	GA
6	Katz	Gary	7106104	GA
7	Kriekoff	Way	4009000	VA
8	Lean	Gina	4954060	CA
9	Levin	Jennifer	1350005	TN
10	Lord	Josie	5201550	NY

In *Paradox*, you create a query by placing check marks within the framework of a table. This query asks for records where the last name falls between the range of "H" and "L." Matching records appear in an answer table below the query.

from two tables. For example, you can create an invoice record that lists the customer information in a header, and then individual transaction items in a multiple-line form on the same screen. You use a

function key to move back and forth between the two regions.

Paradox also has some strong features in the output department. You can create an "instant report," or use the custom report feature. The program relies on a "band" approach to report definition, with each band representing a level of grouping. Don't want just a list of names

and numbers? Okay, how about a graph? *Paradox* can create a wide variety of graphs using your data, including bar, stacked, line, and pie graphs.

SCRIPTS, PROGRAMMING, AND PAL

Even if a program is this easy to use, it can get tiresome if you have to issue the same commands over and over. *Paradox* gives you many different ways to program, varying in degrees of complexity.

Paradox programs are called scripts, and the easy way to create one is to simply

record it. Select "BeginRecord" and the program will record every keystroke until you select "EndRecord." The result is a text file that you can edit with *Paradox's* script editor or any other text editor. You can then go in and modify or add to your script. In a similar manner, you can record and play back queries.

The next step in programming is the Personal Programmer, which allows you to create custom menus and procedures that will guide you through a series of *Paradox* operations without having to know much about the program. This is essentially a code generator that produces scripts, and you can edit the results to make further modifications.

Finally, you can write your own procedures directly in PAL, the *Paradox* Applications Language. This is a full-featured language that includes dozens of different commands and options. You can also get the *Paradox* Engine, a library of C functions and Pascal procedures that you can use in single and multiuser applications.

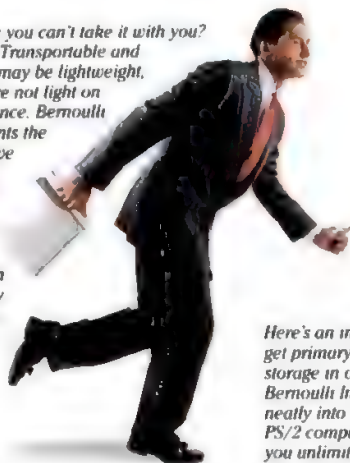
BLAZING SPEED

You might expect that a program this easy to use might be slow. You might think that creating all these temporary answer tables



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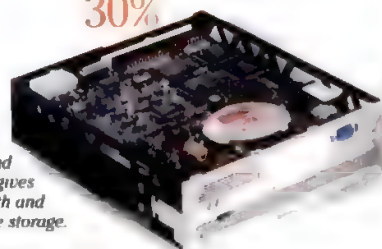


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and using procedures that mimic menu operations might be slow, but you'd be wrong.

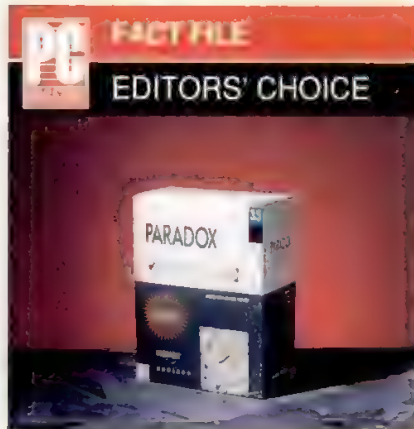
Paradox is very fast. On PC Magazine Labs' benchmark tests, *Paradox*'s performance was near the fastest in many of the operations, even when it had to perform intermediate steps with temporary tables first. This speed was more evident in the 10,000-record tasks; some of the 100,000-record times were not as close to the front of the pack. Even with very large database applications, however, you are likely to find *Paradox* plenty fast. It even beat *FoxPro* on some complex joins.

PHILOSOPHICAL DIFFERENCE

There are still some problems with the program, however. The philosophy behind the structure is quite different from more-traditional database development tools and may require a bit more learning. To Borland's credit, the company has created some of the most attractive documentation around. Abandoning the traditional binder in favor of 8.5-by-11 paper-back books, you get large pages filled with useful illustrations and clear examples.

This still leaves some complex ideas to

OTHER STORY RELATIONAL DATABASES



Paradox, Version 3.5
Borland International Inc., 1800 Green Hills Rd., P.O. Box 660001, Scotts Valley, CA 95067; 408-438-5300.
List Price: \$795; *Paradox Multi-Pack* (five users), \$995; *Paradox Engine*, \$495; *Paradox SQL Link*, \$495.
Requires: 512K RAM, DOS 2.0 or later.
In Short: *Paradox* takes its own approach to database development, but once you get the hang of its structure, it provides an impressive combination of ease, power, and speed. There are some quirks, but they are few compared to the many attractive features offered in this package.

CIRCLE 418 ON READER SERVICE CARD

adapt to, however. For example, if you have a query that you perform frequently and want to format in a given report layout, there are many steps involved. You must first create a dummy table with an identical structure to the query's resulting ANSWER table, and then create your report format for that table. You then create a script that will open the source table, perform the query, save the ANSWER table to a new name, copy the report format from the dummy table to the renamed ANSWER table, and then execute the report. It is not that hard once you get the hang of it, but it does take some adjustment.

Paradox also has multiuser capabilities. The same package can be used as a standalone version or as a multiuser version. You need to have one copy per user, or buy "bump" disks to install on your network, but at least you do not have to buy a different version for different environments.

Paradox may take a little getting used to, but the effort will be worthwhile. Once you learn your way around the menus and the query structure, *Paradox* is a fast, powerful, and easy-to-use database management system.

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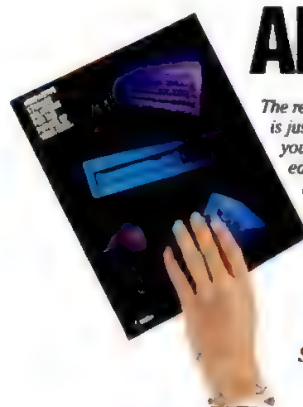
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Ramis/PC Workstation

by Katherine Emery

Ramis/PC Workstation, Version 3.0, was created to provide a PC link to mainframe *Ramis* applications so PC users can generate ad hoc reports off-line and query mainframe data without needing separate terminal access. This \$595 system from

SUITABILITY TO TASK

Ramis/PC Workstation

Data loading and access	☒	☒	☐	☐
On-line inquiry	☒	☒	☒	☐
Ad hoc reporting	☒	☒	☒	☐
Professional applications development	☒	☐	☐	☐
End-user applications development	☒	☒	☒	☐

On-Line Software International also allows mainframe developers to prototype applications on the PC and port them to the central machine later. In this capacity, *Ramis/PC Workstation* hits its mark, but shortcomings appear as you try to develop complex applications that require file and index creation within a program, complicated file schema with field lengths over 77 characters, or composite indexes of more than four fields.

Pop-up menus and function keys drive *Ramis/PC Workstation*, and while the placement of some menu selections is not intuitive, there is uniformity in the interface that allows new users to get comfortable quickly. The Workstation Manager, the umbrella for all *Ramis/PC Workstation* functions, provides seamless menu access to data and command files so you don't have to remember where files reside or how to invoke them. The Workstation Manager also provides access to DOS utilities including the ability to view a directory, copy, erase, print, and display files, so users without knowledge of DOS commands can manage their *Ramis* files.

The system comes with three binders of documentation that clearly explain the basics. The on-line help is not very helpful, and there is not much technical information available for sophisticated users. The best route for answers to technical questions is through free phone support.

You can select some particularly helpful data input attributes including default values, conditional default values, default to previous, increasing and decreasing transaction numbers, not required or required, skip at input, and formula-based input. On the negative side, a 77-character maximum field length is unreasonably restrictive.

MAINFRAME FILE ACCESS

Ramis/PC Workstation allows you to easily extract data from several popular PC file formats including *Lotus 1-2-3*, *dBASE*, *.DIF*, and delimited and fixed-length records. The system also accesses mainframe *Ramis* files and offers an easy way to match two files so that data can be brought over from one file with similar data, but disparate field names, from another file.

There are two ways to generate reports: by selecting from menus or by building request files at the command-line level using one of *Ramis/PC Workstation*'s two full-screen editors. In a nice marriage of methods, the system creates a command request file so a novice can generate a report using the menu-driven



Using *PC MATCH*, *Ramis/PC Workstation* allows you to link files with disparate field names for relational links and importation functions.

system, and the more-experienced user can later edit it from the command-line level. An expert user can write routines that a novice can later select from a menu.

On *PC Magazine Labs'* tests, *Ramis/PC Workstation* took just under three hours to load and index 10,000 records. The package did not complete the loading and indexing of the 100,000-record database within the 40-hour time limit. Even more distressing is that each index takes progressively longer to create because *Ramis*'s indexing architecture puts all the indexes for a file in one large file.

LIMITED DEVELOPMENT TOOLS

The most glaring omission in *Ramis/PC Workstation* is a substantive applications development tool. Applications are run by command files that include macro instructions to direct the system through menus. This menu-based flow limits your ability to develop sophisticated interactive applications.

Complex functions are awkward at best, and sometimes are just not available. For instance, you cannot automate data-file creation or indexing in a command file. With no debugging tools and no links to other languages, you will have a tough time troubleshooting. And there is no applications generator to speed up development time.

The lack of form-based reports is another glaring omission, and lack of printer support makes any sophisticated output dependent on cumbersome escape sequences. You can build nested query



Ramis/PC Workstation, Version 3.0
On-Line Software International, Fort Lee Executive Park, Two Executive Dr., Fort Lee, NJ 07024; 800-526-0272, 201-592-0009.
List Price: \$595.

Requires: 640K RAM, DOS 3.0 or later.
In Short: *Ramis* is an easy-to-use, pop-up menu database query and reporting tool for end users. However, its lack of a sophisticated applications development environment will preclude its use for more complicated demands.

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COVER STORY RELATIONAL DATABASES

command statements via menu selections of conditions. For example, (AGE > 65.AND. (SALARY < 12K.OR. RETIRED='Y')). These queries can be stored in query procedures for later use.

If *Ramis PC/Workstation's* aim is to satisfy the needs of the low-end user, it succeeds in giving this group functionality from menu-selected query and ad hoc reporting selections. For anyone attempting applications development with more than a modicum of complexity, look out. *Ramis/PC Workstation's* menu-oriented applications development environment is restrictive. And for low-end users, there are more-flexible and functional tools available with the same ease as *Ramis/PC Workstation*. If you have *Ramis* on a mainframe, however, and are looking to turn your PCs into terminals with 3270 emulation and to provide the opportunity to off-load some of the mainframe's work, *Ramis/PC Workstation* may be quite beneficial.

● R:BASE by Joe Salemi

Through its many versions over the years, *R:BASE* has held a strong place among the top three PC-based databases. A previous version earned an Editors' Choice for its SQL implementation, pseudocompiler, and interface. Microrim's latest version, *R:BASE*, Version 3.1, adds enough new features to make it a serious contender for the top spot. The \$795 package combines an intuitive interface, the ability to directly manipulate *dBASE* files, and applications development prowess to make it easy for end users and developers to build complex databases and applications.

The main screen in *R:BASE* consists of a menu bar across the top and a status line

along the bottom. The menu bar lists the major categories of functions, with each choice leading to a pull-down menu (accessible through the keyboard or a mouse) that guides you along the steps necessary to create and use a database. From the opening Databases menu, you choose an existing database or create a new one. The Tools menu gives you access to the operating system, as well as to the routines to backup and restore databases, and import and export data.

A TRADITIONAL APPROACH

The other menus are context-sensitive, altering their choices depending on whether you're using or modifying an existing database, or creating a new one. In designing and accessing a database, *R:BASE* uses the traditional relational approach of tables, columns, and rows. These correspond to the files, fields, and records of the *dBASE* model.

When creating a database, the Info command leads to a second screen where you define tables, set columns to auto-numbering, set rules for data entry and validation, and define access rights to the data. For existing databases, you have the choice of modifying the tables or doing ad hoc queries.

One of the features added to *R:BASE* is a powerful Query By Example (QBE) method, similar to the QBE in *Paradox*, right down to the checkboxes. The greatest difference between the two is that *R:BASE* doesn't create a permanent "Answer" table of the query results. Instead, it's treated as a relational view that you can save for later use. The query results are presented in tabular form that you can browse or edit.

Other main menu items are Views, Reports, and Forms. All three use variations of *R:BASE's* screen painter and generator for creating or modifying their respective actions. The screen painter includes a handy feature (similar to *Advanced Revelation's*), that lets you test the forms or reports prior to saving them, to insure that you're getting the results you expect. In an existing database, the pull-down menus expand to list the existing forms, views,

deptno	deptname	empno	empname	empjob
10	Accounting	2825779	Fila	Samatha
10	Accounting	3176294	Gabriel	Joan
10	Accounting	3229478	Gill	Justine
10	Accounting	3577884	Horch	Joan
10	Accounting	4866370	HinLucky	Quarney
10	Accounting	4127884	Giles	Quarney
10	Accounting	4544884	Salas	Elizabeth
10	Accounting	5867881	Delan	Elizabeth
10	Accounting	6363880	Travis	Elizabeth
10	Accounting	7186184	Eds	Gary
10	Accounting	7186184	Eds	Gary
10	Accounting	7186184	Eds	Gary
10	Accounting	7331886	Greenberg	Taylor
10	Accounting	9168885	Naughton	Robert
10	Accounting	9576884	Wentz	Samatha

In this screen, *R:BASE* is handling an ad hoc query with its Query By Example interface. The package makes queries like this fast and simple.

and reports for you to use. The Exit menu gives you the choice of exiting to the familiar "R>" prompt or to the operating system.

APPLICATIONS DEVELOPMENT

R:BASE's greatest strength is the Applications Generator, the final choice on the main menu. With it, you can create sophisticated, menu-driven applications with little or no custom programming or even programming skills. The Applications Generator steps you through the process of creating menus and assigning actions



R:BASE, Version 3.1
Microrim, 15395 S.E. 30th Place, Bellevue, WA 98007; 206-649-9500.
List Price: \$795.
Requires: 640K RAM, DOS 3.1 or later.
In Short: *R:BASE* has an easy-to-use interface, but doesn't compromise when it comes to programmability. Its *dBASE* links make it an excellent alternative to *dBASE IV*.

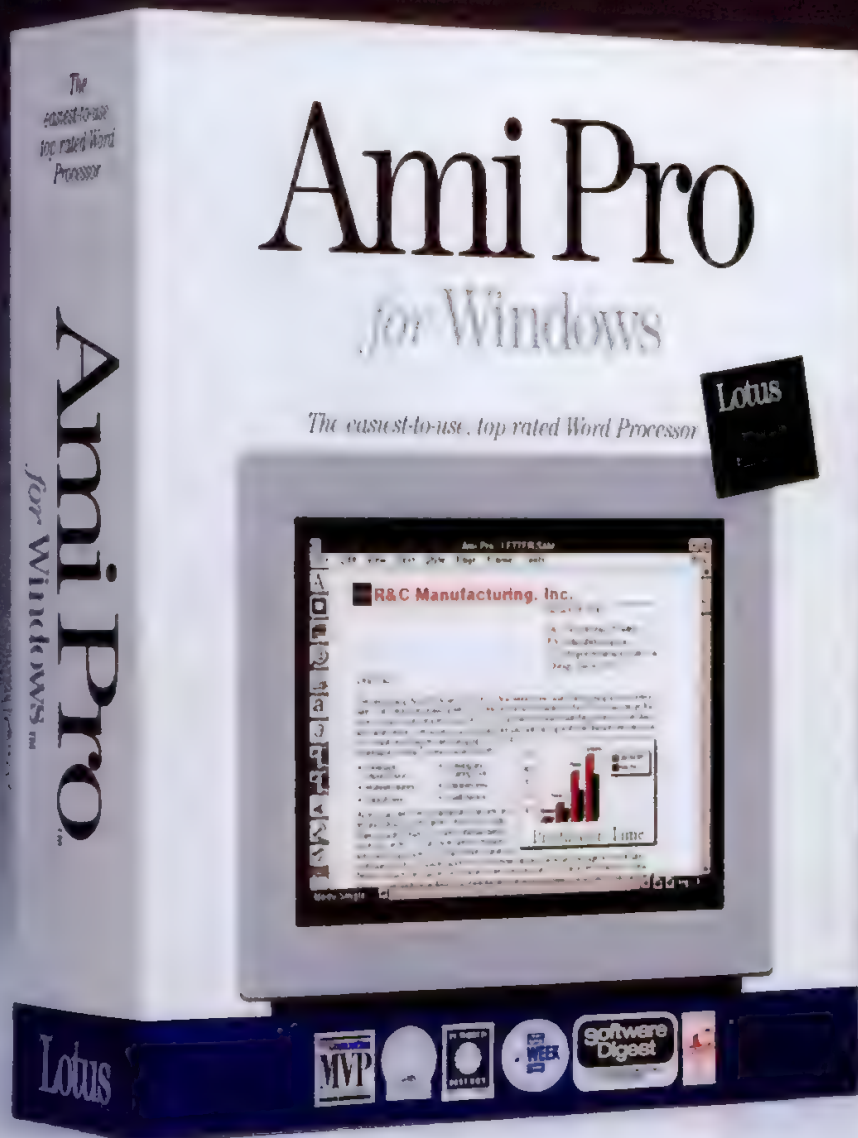
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SUITABILITY TO TASK

R:BASE

Data loading and access	☒	☒	☒	☒
On-line inquiry	☒	☒	☒	☒
Ad hoc reporting	☒	☒	☒	☒
Professional applications development	☒	☒	☒	☒
End-user applications development	☒	☒	☒	☒

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*Independently conducted Windows word processing Usage & Attitude Study, November 1990. Figures cited are among Word for Windows users that are also users or triers of Ami Pro.

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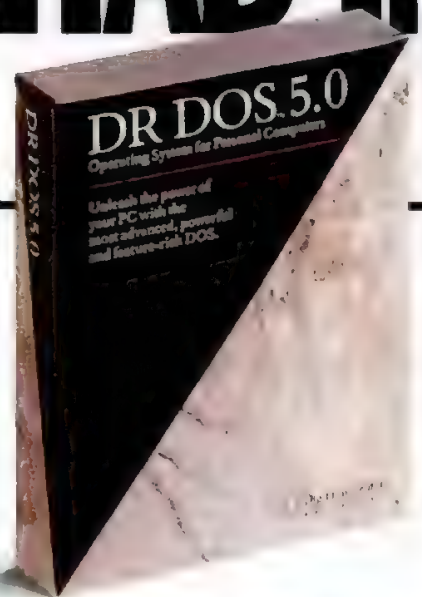
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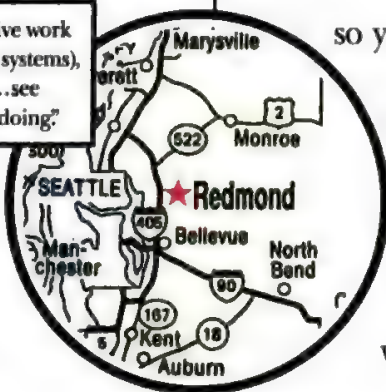
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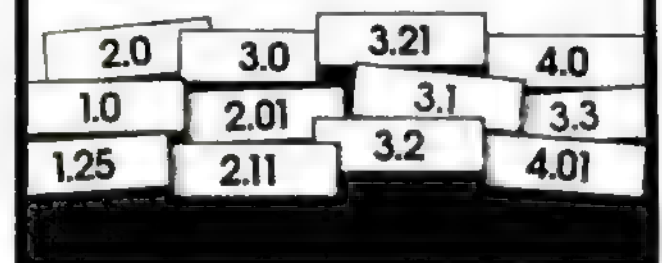
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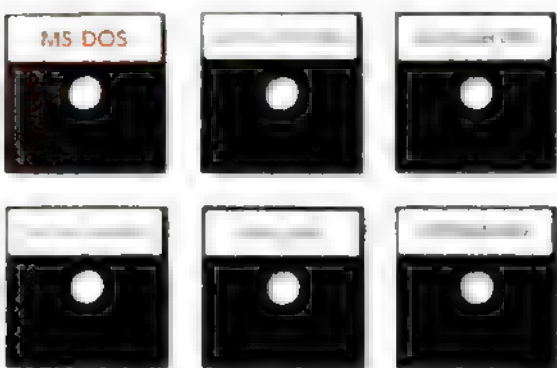
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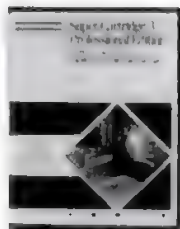
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or submenus to them. *R:BASE* supports a variety of menus, including the menu bar, pop-ups, and cascading style. If necessary, the Applications Generator loads the appropriate module so you can create or modify forms, views, and reports. When you're finished, *R:BASE* writes the code for you and saves it to disk.

The native command language in *R:BASE* is compatible with ANSI SQL (with *DB2* extensions). Programmers familiar with SQL will feel right at home. Although you can write applications entirely from scratch, it makes more sense to use the Applications Generator to create the basic code and then add custom routines and features as you need them. The only weakness in *R:BASE*'s programming facilities is the lack of strong debugging tools. When you're finished programming,

***R:BASE* can
directly
manipulate *dBASE*
files using *R:BASE*
commands.**

you can use the Codelock module to encrypt the application and prevent user modification.

A SERIOUS *dBASE* ALTERNATIVE

The security features of *R:BASE* are quite good, giving you complete access to the data, down to the column level (*R:BASE* uses the SQL "GRANT" and "REVOKE" security commands). Setting up *R:BASE* for a multiuser application is as simple as changing a "SET" command. The system supports full transaction processing and imports and exports a wide range of data formats.

R:BASE 3.1 has an added feature that makes it competitive in a world dominated by *dBASE*—its ability to directly manipulate *dBASE* files using *R:BASE* commands and features. While there are some limitations (explained in the manuals), this ability makes *R:BASE* a serious alternative to *dBASE*. A feature noticeably absent in *R:BASE*, though, is the ability to access data from any of the common database servers.

R:BASE's overall performance on the 10,000-record tests was uneven: It was

COVER STORY RELATIONAL DATABASES

very fast on the Project test, but performed the slowest out of all 15 packages on the coded Report test. Though *R:BASE* took over 43 hours to load and index 100,000 records, its subsequent performance on the 100,000-record tests was surprisingly good, with the package consistently rating in the top 5.

To optimize large database processing, Microrim recommends that users buy *R:SCOPE*, a \$129 *R:BASE* utility collection that includes INDEXR, a utility that will significantly speed the building of large indexes, perhaps by up to 40 percent. *R:SCOPE* was not shipping in time for this evaluation.

With its intuitive menu structure and excellent Applications Generator, *R:BASE* 3.1 makes database creation and management easy. Those new to databases or those looking for an alternative to *dBASE IV* should give it serious consideration.

Superbase 4 by Joe Salemi

Only two of the 15 databases that we've reviewed here are *Microsoft Windows* applications—Precision's *Superbase 4* and Blyth Software's *Omnis 5*. Users familiar with character-mode databases might find the \$695 *Superbase 4*, Version 1.2, sufficient cause to rethink their assumptions on how a database should be designed and accessed. *Superbase 4* uses the *Windows* graphical environment to present data in a format that can re-create paper forms, yet it is also a powerful database system that rivals the top character-mode databases for speed and features.

Superbase 4 consists of two parts that

SUITABILITY TO TASK				
Superbase 4				
Data loading and access				
On-line inquiry				
Ad hoc reporting				
Professional applications development				
End-user applications development				



Superbase 4, Version 1.2
Precision Inc., 8404 Sterling St., Irving, TX 75063; 214-929-4888.
List Price: \$695.
Requires: 640K RAM, *Microsoft Windows* 2.x or 3.0, DOS 3.2 or later.
In Short: A powerful database for *Windows* with many graphics-oriented features that may take some getting used if you are experienced in character-mode databases.

CIRCLE 421 ON READER SERVICE CARD

use *Windows* features for creating, designing, and running applications. You create, query, program, and display databases in the main program. *Superbase 4* stores a relational table as a single file, with data in fields and records. The menu option for a new file opens a dialog box where you define the fields for the database. There are three basic data types: Text/Logical, Numeric, and Date/Time. The submenu for each type contains additional options to control the contents and display format of the field. You must index one field in every database file as unique or normal and define the validation rules for each field.

GRAPHICS ADVANTAGES

Virtual and external fields are subtypes of particular interest. A virtual field links a common field in two database files but stores the data in only one of them. There is a performance penalty using a virtual field, but disk savings in not having to duplicate data in two files could be substantial.

The external field is a special type of text field in which the field value is actually the name of an external file. The file could contain text such as a large, custom help file. Or more important, the external file could be a graphics image (.PCX, TIFF, .IMG, or .WMF) that *Superbase 4* displays along with the record on-screen. This ability is useful in an inventory database, for example, where you want to



Superbase 4, a Windows-based database package, can include graphics on a data-entry form. Note the VCR-like buttons across the bottom of the screen.

display a scanned picture of a part along with its description.

The second part of the *Superbase 4* system is the Form Designer. This is a separate application that you run directly from *Windows* or from the RUN option on the System Menu. The Form Designer resembles other *Windows* drawing packages, which use the mouse, ruler lines and grids, and a toolkit to lay out the form. You can include graphics in a form, making it easy to re-create a company invoice.

The Form Designer is also where you create explicit links for one-to-many relations. When you choose the option to create a link between two (or more) database files, the system presents a flowchart of the different files. As you create each link, *Superbase 4* adds boxes to the flowchart that list the linked fields and draws a line to represent the link. This flowchart serves as a visual reminder of the relationships in the overall database.

BETTER THAN BASIC

Superbase 4's programming language, DML, is a superset of structured BASIC. It has commands that affect files, records, processing (including mail-merge and labels), reporting and forms, and input/output, including user-defined menus and dialog boxes. DML also includes a small set of commands for controlling serial communications and commands that set up and control DDE (Dynamic Data Exchange) links. You can debug applications using single-step mode and breakpoints.

Considering the overhead that *Windows* adds, *Superbase 4's* performance is very good. The package landed in the middle of the pack on the loading, indexing, selecting, and joining tests. *Superbase 4* benefits from being a *Windows* application because much of the code overhead, such as printing and displaying menus, is handled by *Windows*.

The switch to *Superbase 4* may be difficult for users accustomed to character-mode databases. Part of the problem lies in menu choices that combine functions that are usually separate steps in other databases. New and experienced database users may find that the menus and icons in Form Designer are not intuitive and require extensive use of the on-line help and the manuals. The on-line help is very good, but the manuals are not well organized, so you have to skip around to different sections to find out how to do something. Finally, data security is limited and cumbersome, requiring custom programming to control access to particular fields in a database.

In fairness to Precision, some of these problems stem from users' unfamiliarity with *Superbase 4's* object-oriented approach. Precision expects that Version 1.3 (due to be shipping in April) will fix most of these problems and add access to the *Microsoft/Sybase SQL Server*. When access to other database servers becomes available, users will be able to upgrade for free.

Superbase 4 is not for you if you have no desire to move to a graphical environment. However, if you're already working in *Windows* or have the need to include graphics images in your database, you should give *Superbase 4* strong consideration.

VP-Info Professional by Bruce Brown

If you're a nonprogrammer who'd like to try out a database programming language that doesn't cost too much, yet comes with lots of features and good user support, then Sub Rosa Publishing's *VP-Info Pro-*

fessional is a good choice. Or if you're a programmer who sets up database applications for end users, you might want to consider this package for its array of tools and functions. With the programming tools you get for \$189, *VP-Info Professional* is a bargain for a single-user package.

VP-Info has been published in various versions under different names since 1984, which is why it probably sounds familiar. The package became fairly well-known in 1986 when Paperback Software International was marketing it. Last year, however, Sub Rosa Publishing, the original developer, bought back the rights to the program and published the current *VP-Info Professional*, Version 4.23. A subset of the package, called *SR-Info*—similar to the first Paperback Software International release plus some added features—is available as a shareware program for a \$50 license fee.

FUNCTIONAL SCREENS

VP-Info's user interface is not for the easily intimidated: you're confronted with a simple command prompt that Sub Rosa refers to as Conversation Mode. This uncluttered interface often appeals to knowledgeable programmers but leaves novices wondering if they should take up rug latching. To ease the way, you can access a menu-driven help system with cross-referenced topics and make function-key commands, program assignments, or keystroke macros.

Neither a *dBASE* clone nor a *dBASE*-compatible program, *VP-Info* does read *dBASE* data files directly. While many of the commands, functions, and structures used in *VP-Info* are the same or similar to those used in *dBASE II, III, and IV*, the program language includes many commands and structures that are different from those in *dBASE*. *VP-Info* compiles

SUITABILITY TO TASK

VP-Info Professional

Data loading and access	☒	☒	☒	☒
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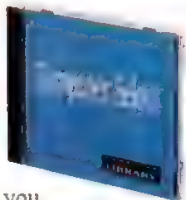
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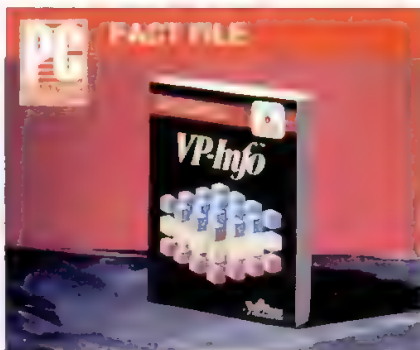
COVER STORY RELATIONAL DATABASES

high-level language programs on-the-fly and features a structured language with flow-control functions such as command grouping, looping, and conditions.

When you run a program by name in *VP-Info*, the system first searches for a compiled program with a CPL file extension. If *VP-Info* doesn't find a compiled program, it looks for an uncompiled source code program with the .PRG extension, compiles it, and runs it immediately.

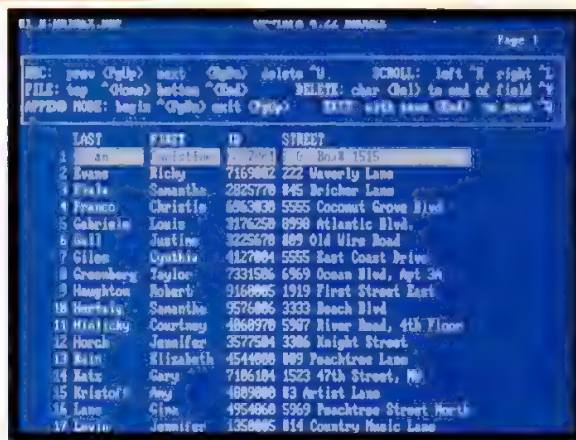
SPEED ADVANTAGE

VP-Info program files run quickly because the program always runs compiled code. The flexibility of running both pre-compiled and compiled programs is a decided advantage over those programs that run only slower, high-language code or compile programs as a separate step. *VP-Info* is a fast package, especially in creating indexes for which it uses a B-tree method. The package was second fastest in completing the 10,000-record loading and indexing, and fifth fastest on the 100,000-record Load and Index performance tests.



VP-Info Professional, Version 4.23
Sub Rosa Publishing Inc., 1170 Sheppard Ave. West, #34, Downsview, Ontario, Canada M3K 2A3; 416-398-8414.
List Price: \$189.
Requires: 512K RAM, DOS 2.0 or later.
In Short: You don't have to be a programmer to use *VP-Info Professional*, but you must be comfortable with command-line operation rather than menus or fill-in-the-blank screens. The package has a rich programming language and compiler, making it most appropriate for programmers.

CIRCLE 422 ON READER SERVICE CARD



This *VP-Info Professional* screen shows a formatted dBASE-style Browse display of a test database. Screen movement commands are listed in a help box above.

Sub Rosa provides several support features for *VP-Info*, including a comprehensive manual, a fully developed fundraising application to use as a model for entry, editing, and reporting with multiple file applications, and good on-line help. The company also participates on-line in CompuServe (number 72010,1323, name SUB ROSA) and publishes a quarterly magazine, *Info Diskazine*, on disk with bug fixes, product upgrades, and other helpful information about *VP-Info Professional*. The on-disk magazine costs \$25 for an annual subscription.

VP-Info doesn't come with features such as built-in security, predefined data validation techniques, or Query By Form or Example. You can, however, write programs for data validation at the time of data entry and for queries with menu-driven compiled query options, though the latter doesn't make ad hoc queries any easier. *VP-Info* has a good variety of aggregate and mathematical functions, but no financial or statistical functions to take advantage of.

Best used by database programmers, *VP-Info* is recommended for those who need to create large applications that must run as quickly as possible. The flexible compiling feature is also an attractive addition to this database applications language. *VP-Info* doesn't have all the predefined or programmed features of some of its most notable competitors, but it does have the means by which a computer craftsman can build tools to aid database programming.

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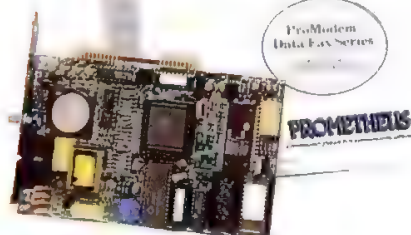


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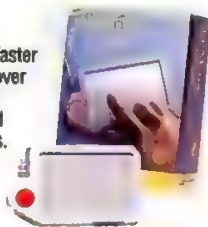
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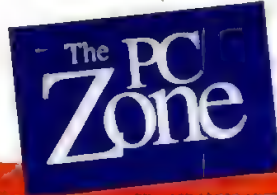
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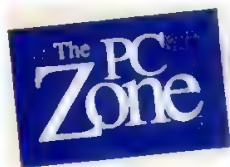
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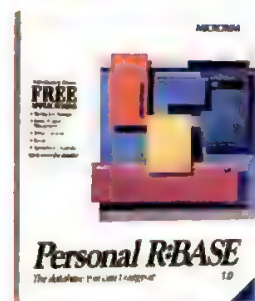
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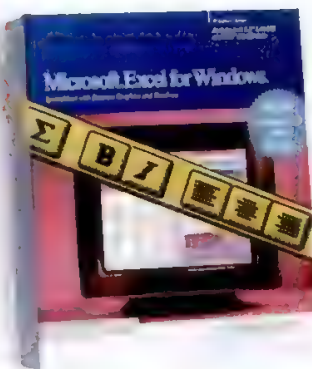
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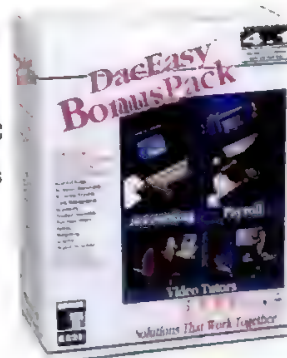
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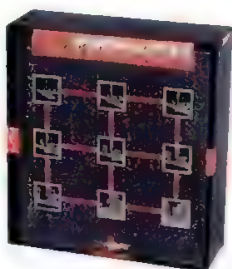
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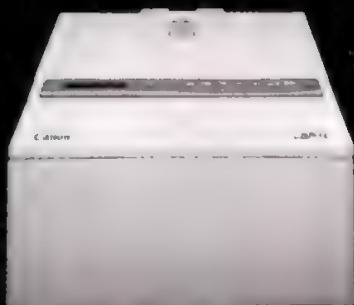
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GET SERIOUS:

Smart Printer Sharing With the HP LaserJet III Si

**Hewlett-Packard's new
\$5,495 17-ppm LaserJet
heralds a new generation of
high-speed printers
that are designed for shared
environments.**

by Alfred Poor



A year ago, you could find the hottest news in laser printing at the low end of the market. Led by Hewlett-Packard's 4-page-per-minute HP LaserJet IIP, a new breed of \$1,000 personal page printers made headlines. This year, laser printer vendors are concentrating on the high end, introducing high-speed printers that are designed for shared use and carry price tags up to \$10,000. HP is at the forefront again with its \$5,495 17-ppm HP LaserJet III Si,

which promises street prices under \$4,000 for the base-priced model and less than \$6,000 for a fully outfitted one (see First Looks, April 16, 1991).

As you would expect, the IIISi includes the latest feature set from HP: PCL 5 and Resolution Enhancement Technology (RET), which made their debuts in the LaserJet III. Like the IID and the IIID, the IIISi can handle duplexing, but it will cost you \$695 for the duplex printing tray. And like the other LaserJet III models, the IIISi has an Adobe PostScript option (\$895). By summertime, you'll be able to buy the IIISi as a PCL/PostScript printer for a list price of \$6,595 (which will also include 2MB of RAM).

What makes the IIISi different from

Pluses for the shared environment include high speed, 500-sheet paper trays, and network interfaces.

the rest of the LaserJet III family is its shared-printer features. In addition to high speed, other pluses for the shared environment include two paper trays (each of which can hold a full 500-sheet ream of paper), a new Canon engine rated for 50,000 pages per month, and optional expansion interfaces (\$695 for Ethernet, \$795 for Token-Ring) that turn the printer into a network node.

One nonmultiuser feature of the IIISi that HP is touting is the "micro-fine" toner. Under a microscope, you can see that the toner particles are indeed smaller than those of the III and the IIID, but to the naked eye there's no discernible improvement.

SHARED PRINTERS DEFINED

Shared printers aren't completely new. The nearly \$12,000 QMS PS-2210, which won Editors' Choice in our November 13, 1990, special issue on printers, is a shared printer. New this year are prices under \$10,000 and more-intelligent networking features.

The minimum requirements of a shared printer are 15-ppm text speed, a 500-sheet

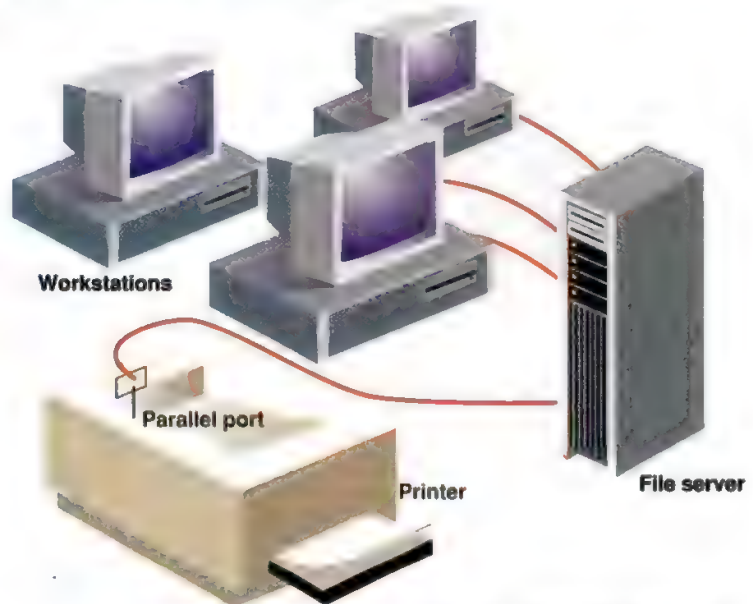
PRINTERS HP LASERJET IIISi



NETWORK PRINTING: THREE CONFIGURATIONS

There are basically three ways to connect a shared printer to a local area network: You can hook it up to a file server, to a print server, or directly to the network. If you have an HP LaserJet IIISi, this last option is your best bet, since it gives you maximum performance with minimum hassle and expense.

THE FILE SERVER DOES IT ALL



Traditionally, a file server manages network printing. This is the simplest approach: After you connect one or more printers to the file server, they can be shared by LAN workstations. Just about any printer—including the HP LaserJet IIISi and the Kodak Ektaplug 7016—can be used with a file server, but you run the risk of overburdening the server. Also, because your printer must be near the file server, and the

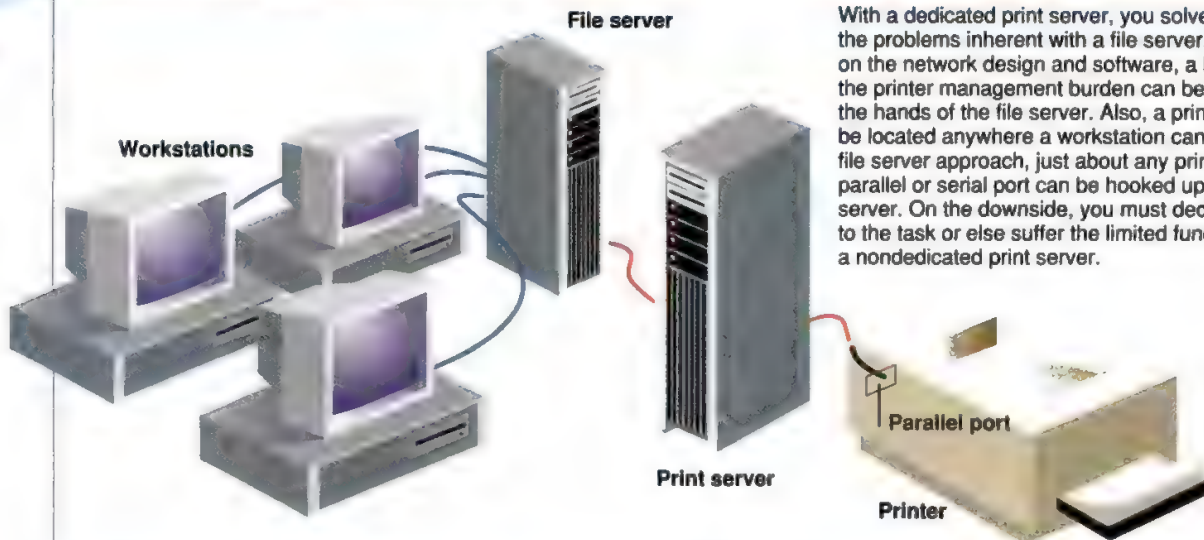
length of a parallel-port cable (10 to 15 feet) or serial-port cable (50 to 150 feet) further limits the printer location, you may be stuck housing it down the hall or even on another floor. (For inexpensive multiuser printing solutions not dependent on LANs, see "Zero-Slot Lans," *PC Magazine*, April 24, 1990, and "Buffered Printer-Sharing Devices," *PC Magazine*, April 30, 1991.)

paper tray, and a 20,000 page-per-month duty cycle. Other features that make a printer especially well suited to the shared environment are multiple ports that can be simultaneously active, automatic switching between PCL and PostScript, and direct network connections.

HP is not alone in the shared-printer arena. Kodak, QMS, Texas Instruments, and other major players are bringing out new entries this year. Kodak has released the \$5,495 Ektaplug 7016, a 16-ppm printer

that includes a 6-ppm convenience copier. (See the sidebar "Kodak Ektaplug 7016: A Multifunction Solution for Multiuser Printing" in this article, and "Kodak's \$5,500 Hydra Combines Workgroup Printing and Convenience Copying," First Looks, *PC Magazine*, March 26, 1991.) Texas Instruments' new 16-ppm printer, the microLaser XL, costs \$3,449 for a LaserJet II-compatible base-priced model. It has only a 250-sheet paper tray, but an additional 500-sheet

USING A DEDICATED PRINT SERVER

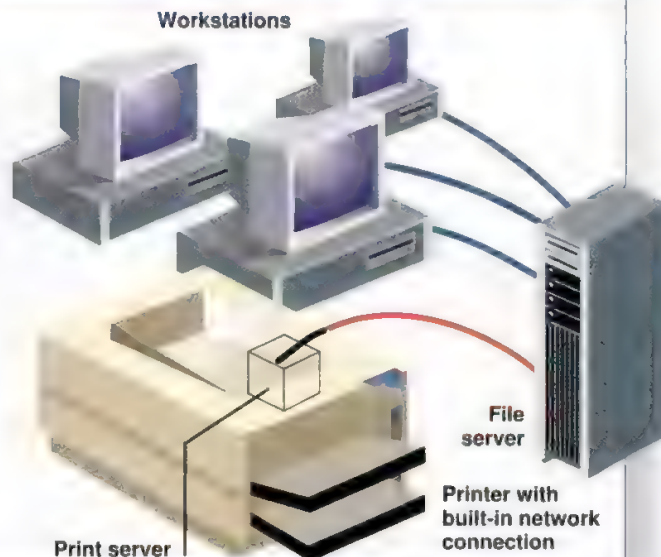


With a dedicated print server, you solve some of the problems inherent with a file server. Depending on the network design and software, a large part of the printer management burden can be taken off the hands of the file server. Also, a print server can be located anywhere a workstation can. As with the file server approach, just about any printer with a parallel or serial port can be hooked up to a print server. On the downside, you must dedicate a PC to the task or else suffer the limited functionality of a nondedicated print server.

JUST ANOTHER NODE ON THE NETWORK

One of the newest and best approaches is to install a network interface adapter that allows you to hook a printer directly to the network. Network interface adapters, such as Intel's NetPort (\$695) and Hewlett-Packard's Printer LAN Connection (\$949 for Ethernet and \$995 for Token-Ring), are separate boxes that connect directly to the network on one side and the printer's parallel or serial port on the other. The adapters provide all the benefits of a print server and take up less space; and because the server intelligence and the network connection are built into the adapter, this setup costs \$1,000 less than using a dedicated print server.

The latest twist on this trend is to build the network connection right into the printer. The Kodak Ektaplug 7016 has an optional \$195 AppleTalk interface. The HP LaserJet IIISI has optional expansion interfaces (\$695 for Ethernet, \$795 for Token-Ring) that plug directly into the printer's controller. Because the print stream is sent directly to the printer's controller, rather than being piped through the slower parallel or serial connections, the expansion interfaces yield better performance—up to 25 percent better throughput than you'd get by using the IIISI with a print server or an external network interface adapter.



tray is available for \$495. (Other models offer PostScript and AppleTalk connections.) As we went to press, QMS was readying its 20-ppm QMS PS-2000. At \$15,995, it costs a bit more than the others, but the base-priced model comes standard with PostScript, 8MB of RAM, and (like the PS-2210) the capability to print on 11- by 17-inch paper. Expect to see other announcements shortly; a complete comparative review of the new shared printers will be included in our

special issue on printers this fall.

Five factors must go into a viable shared-printer design: shared-use features, performance (as a standalone printer and as a shared printer), paper-handling options, fonts and emulations, and ease of operation.

MULTIUSER CAPABILITIES

One of the most exciting aspects of the IIISI is its ability to act as a network node. Although you can hook up the IIISI to a

network, file server, or print server via the parallel port, optional expansion interfaces (\$695 for Ethernet, \$795 for Token-Ring) provide far better performance.

One multiuser capability the IIISI doesn't support is simultaneously active ports. Other printers (such as the QMS PS-410, which we reviewed in the November 13, 1990, special issue on printers, and the new QMS PS-2000) offer this. Some printers even allow you to configure the different ports to have different



HP LASERJET IIISI: SWIFT SINGLE-USER SPEEDS AND LASERJET III-QUALITY OUTPUT

Like the HP LaserJet III and IIID, the \$5,495 HP LaserJet IIISI supports PCL 5 (which produces rotatable and scalable fonts) and HP's Resolution Enhancement Technology (which eliminates jagged curves and slanted lines). New features for this shared printer include a new high-speed 17-ppm Canon engine, optional expansion interfaces for networks, and two 500-sheet paper trays.

As with the III and IIID, the IIISI produced excellent images on our PC Magazine Labs printer tests. Solid black areas are evenly covered, with no blotches or frayed edges, and text output is outstandingly crisp and clean; however, the effects of the new microfine-particle toner were visible only under a microscope. The IIISI printed about twice as fast as the earlier LaserJet III-family models.

HP LaserJet IIISI

\$5,495

A Canon engine-based 17-ppm PCL 5 laser printer with Adobe PostScript and duplexing options, the IIISI accepts HP LaserJet font cartridges and soft fonts.

TEXT SPEED 15.0 ppm
ONE PAGE OUT 15 sec.
GRAPHICS SPEED 3.5 gppm
GRAPHICS TIME 0 min. 17 sec.



Man's mind cannot grasp
of events in their complete
but the desire to find the c
is implanted in man's soul
Courier **Bold Under**
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printer command languages active: You can set up the Kodak Ektaplug 7016's serial port for PostScript and its parallel port for LaserJet emulation. Not only does the IIISI not have this sort of feature, only one of its two ports—one parallel and one serial—can be active at a time.

This is not as serious a limitation as it might first appear. One common way of sharing a printer is on a local area network (LAN). With most LAN setups, you attach a shared printer directly to a server. In this case, all you really need is a single port on the printer.

However, since you might not want a shared printer in the same location as the network file server, and you might prefer not to dedicate an entire computer to the role of print server, optional adapter cards that plug right into the IIISI's expansion slot permit you to attach it directly to an Ethernet (\$695) or Token-Ring (\$795) LAN. HP offers two versions of each interface, supporting either Novell's *NetWare 386* or 3Com's *3+Open LAN Manager* (see the sidebar "Network Printing: Three Configurations").

The expansion slot offers all sorts of possibilities, and HP has worked with a number of third-party manufacturers to develop options for this feature. One of the companies with products ready at the

The IIISI prints fastest
when connected to
the network through
a Token-Ring
expansion interface.

IIISI introduction was Extended Systems of Boise, Idaho (208-322-7575). It has two printer-sharing products for this newest LaserJet: the \$995 ShareSpool, which allows up to eight PCs to access the printer via parallel ports at distances up to 500 feet, and the \$595 BridgePort, which offers two parallel ports and an AppleTalk network connection so that PCs and Macs can share the printer. Both products also offer automatic language switching between PCL and PostScript; this is similar to the context switching built into QMS's PS-410 and the new PS-2000.

The automatic context switching of the Extended Systems products is an attractive feature, one that is noticeably missing from the \$6,595 PCL/PostScript version

of the IIISI. In our tests on a *NetWare* network, we had to leave the printer in PCL mode and create separate printer definitions for PostScript and PCL print jobs because the network banner pages will not print correctly if the printer is in PostScript mode. The configuration steps for turning the PostScript on and off are not entirely straightforward, and the *Network Notes* manual that comes with the printer does not do a complete job of explaining everything.

PERFORMANCE TEST RESULTS

Speed is a crucial element in shared printing. Fortunately, the IIISI excelled on PC Magazine Labs' standard suite of printer tests and brand-new network printing test.

Under shared conditions, the IIISI really showed its stuff. PC Labs' network printing tests indicate that the 17-ppm HP LaserJet IIISI prints fastest when connected to the network through a Token-Ring expansion interface. Using this option, the IIISI printed text about twice as quickly as the 8-ppm HP LaserJet IIID with HP's \$995 Token-Ring Printer LAN Connection installed. Even more impressive, the IIISI surpassed the speed of the 22-ppm QMS PS-2210, which ran off the parallel port, by over 20 percent on text.

As a standalone printer, the HP Laser-



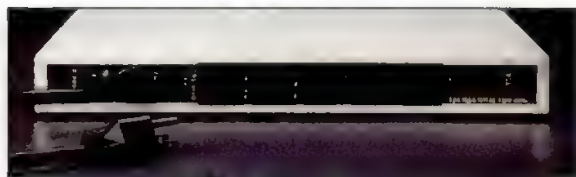
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The OL820: W/200 sheet 2nd paper tray



The OL840: W/200 sheet 2nd paper tray



The OL800: W/multi-user port (3 add'l users)*



The OL820: W/multi-user port (3 add'l users)*



The OL840: AppleTalk Network Ready

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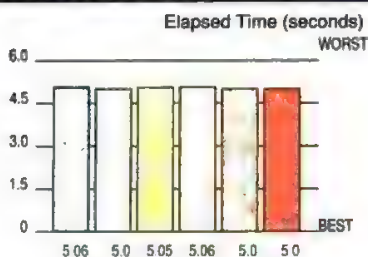
PERFORMANCE TESTS: HP LASERJET III Si

As a shared printer, the 17-ppm HP LaserJet III Si prints fastest when connected to the network through its \$795 Token-Ring interface. Using this option, the III Si completed our tests faster than the 22-ppm QMS PS-2210, which was connected to the

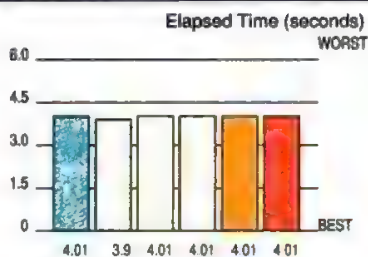
network through its parallel port. The 8-ppm HP LaserJet IIId—with HP's \$995 Token-Ring Printer LAN Connection installed—took roughly twice as long to print as the III Si with a Token-Ring connection.

TIME TO SEND

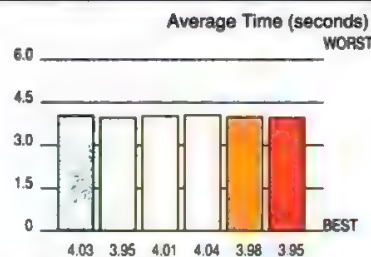
One Station Printing, Five Load Stations



One Station Printing, No Load Stations

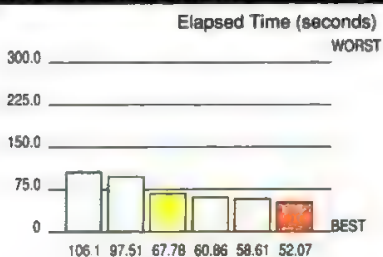


Three Stations Printing, No Load Stations

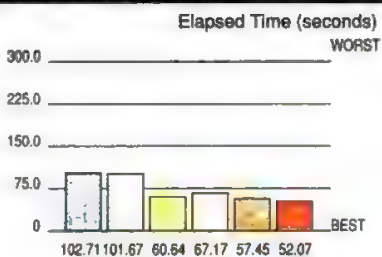


TIME TO PRINT

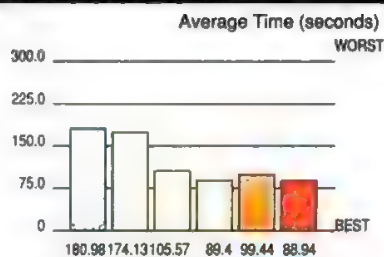
One Station Printing, Five Load Stations



One Station Printing, No Load Stations



Three Stations Printing, No Load Stations



* Reported for comparison.

PRINTERS

HP LASERJET IIISi

For our shared-printer tests, we sent each printer five copies of a standard two-page business letter from a single workstation; we repeated the test with three stations simultaneously sending the same ten-page print job, and then with six stations. We also ran the test with three stations sending the text file and three stations sending a graphics file, all at the same time. Finally, we had one station send the ten-page print job while five other stations put traffic on the network by performing disk reads on the file server (the results of this test are reported first).

For the **Time to Send** test, timing started when the command to print was entered and stopped when control returned to each test program. We then calculated the average time for a workstation in the given configuration to send its print job.

For the **Time to Print** test, timing started when the command to print was entered and stopped when each completed print job emerged from the printer. We calculated the average time for the shared printer to complete the output requested by each station in the specified configuration.

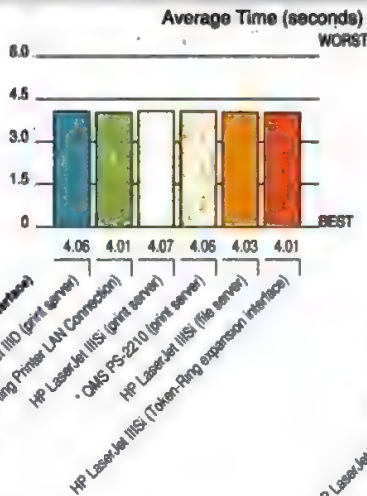
HOW WE TESTED

We tested the HP LaserJet IIISi in a network environment with a Compaq Systempro as the file server, equipped with a single 486/33 processor board, 12MB of RAM, an 840MB Intelligent Drive Array, and a Compaq 32-bit dual-speed Token-Ring controller. The network operating system was Novell's *NetWare 386*, Version 3.10, running in its default configuration. Each of the six Compaq Deskpro 386/25e's connected to the network had 4MB of RAM, a 310MB hard disk, and a Proteon 1346 16-bit Token-Ring controller. As a print server, we used an 8-MHz IBM AT with 512K of RAM, a 30MB hard disk, a parallel/serial adapter, and a Proteon 1346 Token-Ring controller.

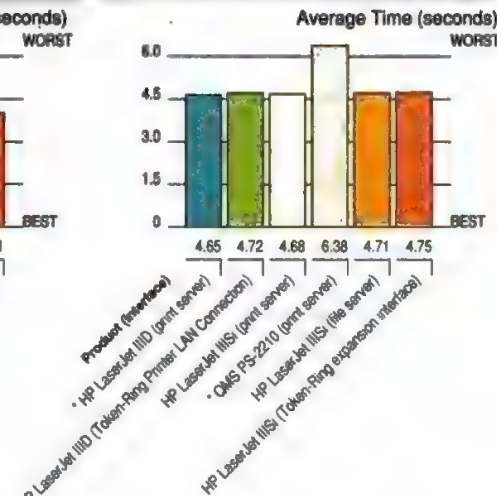
For comparison, PC Magazine Labs ran the HP LaserJet IIISi against an HP LaserJet IIId and a QMS PS-2210. The IIId, an Editors' Choice in last year's special issue on printers (November 13, 1990), has an 8-ppm engine, dual bins, and duplexing capability. The PS-2210—also an Editors' Choice in November—is a PostScript printer with a 22-page-per-minute rating; we tested it using its LaserJet Plus emulation. Each of the three printers was in turn connected to the parallel port of the print server.

Besides testing each printer through the AT print server, we ran further tests with different configurations. We tested the HP LaserJet IIId using Hewlett-Packard's Token-Ring Printer LAN Connection, and we tested the HP LaserJet IIISi using its own Token-Ring expansion interface; in each case the printer now functioned as a node on the network. We also connected the IIISi directly to the file server's parallel port.

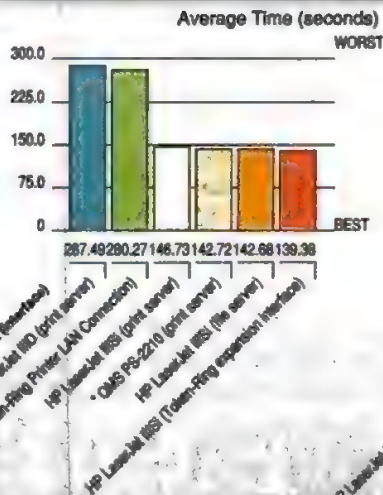
Six Stations Printing, No Load Stations



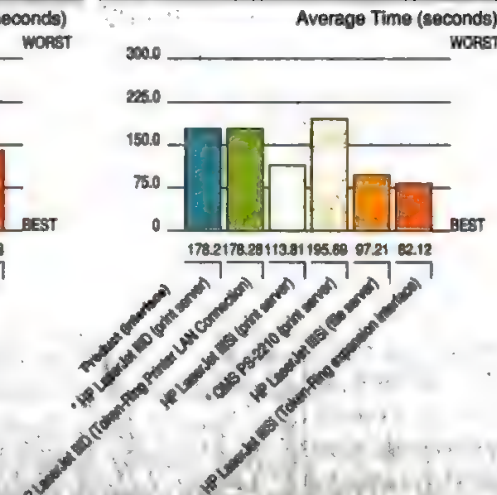
Three Text and Three Graphics Stations



Six Stations Printing, No Load Stations



Three Text and Three Graphics Stations



* Reported for comparison.

CONTINUES



COMPOSITE VIEW: HP LASERJET IIISi

PC Labs' tests indicate that the most significant factor in the new 17-ppm HP LaserJet IIISi's performance as a shared printer is the interface used to connect it to the network. When we ran our Time to Print test with one workstation, the IIISi using the \$795 Token-Ring expansion interface chopped more than 20 percent off the time required by the 22-ppm QMS PS-2210, which was hooked to an IBM AT print server via the parallel port. The 8-ppm HP LaserJet IIID—with HP's \$995 Token-Ring Printer LAN Connection installed—took roughly twice as long to print as the IIISi with a Token-Ring connection.

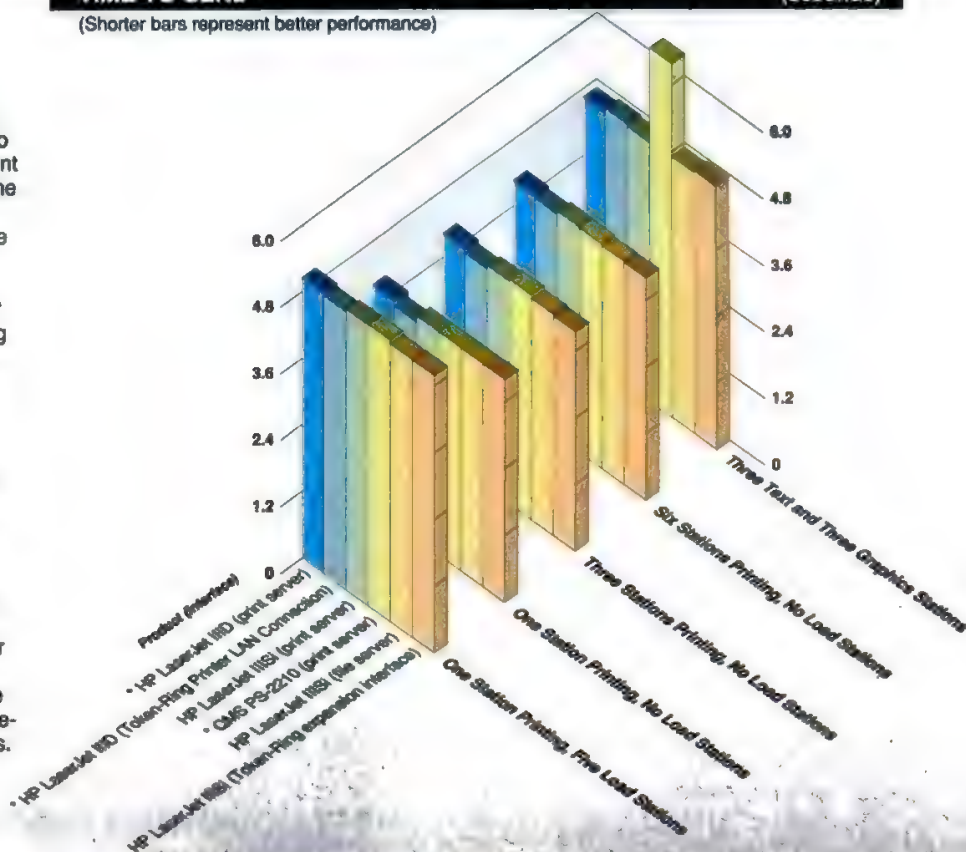
The IIISi hooked directly to the file server was generally almost as fast as when we ran the unit with the Token-Ring expansion interface. Predictably, the parallel port proved to be the bottleneck when the IIISi was connected to the file server.

With the expansion interface, the IIISi proved itself remarkably invulnerable to network traffic from five other stations. For text printing, the time to send a file to a printer is essentially constant, whether the printer is handling a single job or simultaneous jobs from as many as six workstations.

TIME TO SEND

(Shorter bars represent better performance)

(seconds)



Jet IIISi was also speedy. In PCL mode, it clocked in at 15.0 ppm for text and produced our bitmapped graphics page at 3.5 graphics pages per minute (gppm)—about twice as fast as the LaserJet III, which prints text at 7.5 ppm and graphics at 1.9 gppm. In duplex mode, the IIISi ran at 11.7 ppm—nearly twice as fast as the IIID's 6.4 ppm.

Under PostScript, the IIISi managed 14.5-ppm text speed and 1.1 gppm. These scores compare favorably with those of the QMS PS-2210, which produced speeds of 17.3 ppm and 1.0 gppm.

The new Canon engine produced output quality on a par with the other members of the LaserJet III family. The solid black areas were excellent, with no frayed edges or blotchy coverage. As expected, the RET produced smooth curves and outstanding text. But the effects of the new microfine toner were not noticeable—except under a microscope.

The IIISi passed our compatibility tests for PCL Level 4 and PostScript, with one exception. The printer had problems ac-

You can feed the IIISi anything from a full sheet of paper to an envelope.

cepting PostScript code in the interactive Executive mode across a parallel port. This is not a major flaw; however, some printers can handle this mode without any problem.

FLEXIBLE PAPER HANDLING

In addition to the two paper trays, the IIISi offers some other attractive paper-handling features. As with the III and IIID, you can use the top of either tray as a manual feed slot; the edges are adjustable, so you can feed the IIISi anything from a full sheet of paper to an envelope.

If you need to print lots of envelopes, you can get a separate envelope feeder tray (not shipping until this summer, at a list price of \$495), which can hold up to 100 envelopes. This tray mounts in its own area, leaving the two regular paper trays undisturbed.

Like other LaserJets, the IIISi can output its paper in faceup or facedown orientation. Unlike the others, which require you to select the printer's output mode manually, the IIISi can alter its output orientation via software commands. You can also select the output destination through the front-panel controls.

The top paper bin is designed to hold up to 500 sheets. Since this bin could overflow, Hewlett-Packard included a plastic arm that mounts above the output bin; like a float valve in a water tank, it takes the printer off-line when the bin is full. Remove the excess pages and the IIISi resumes printing.

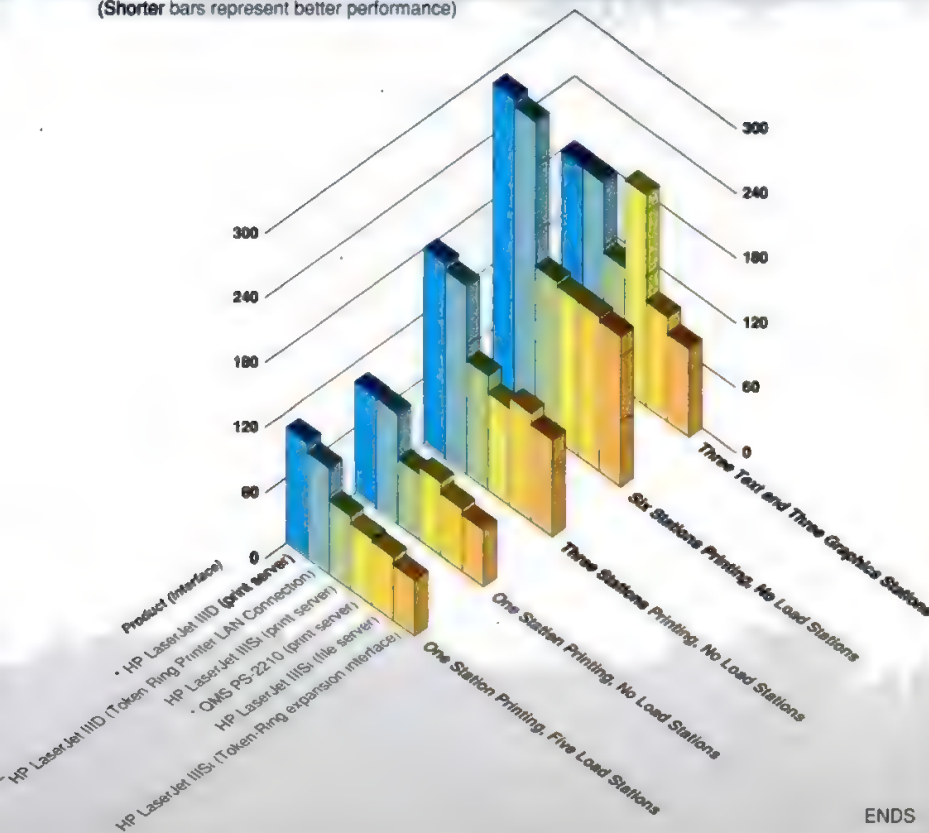
The IIISi output bin also offers a "job offset" feature. The printer can separate print jobs by stacking them in offset piles.

PRINTERS HP LASERJET III Si

TIME TO PRINT

(Shorter bars represent better performance)

(seconds)



italic. The last one is not text at all, but a collection of handy little symbols and bullets for dressing up a document. As in the other LaserJets with PCL 5 support, the fonts can be scaled from 0.25 to 999.75 points. Of course, most software won't support point sizes above 128. (At 72 points per inch, a 720-point character would just about fill a standard-size sheet of paper.)

PCL 5 allows you to rotate these fonts 90 degrees in any direction and print them on the same page. It also supports commands in HPGL, the language used by HP

The IIISi adds four scalable font families to the standard bit-mapped fonts.

pen plotters. You can even instruct the printer's controller to convert scalable text into plotter commands, which can then be used to print the text using a variety of effects (such as printing at any angle or filling letters with a pattern).

Like the other LaserJet III-family printers, the IIISi supports three different types of bit-image file compression. This feature speeds up your computer when it is sending graphics to the printer.

Like the III and the IIID, the IIISi uses RET to get the most from the PCL 5 features. Even though the printer can only create 300 dots per inch, this process lets the engine alter the size and location of each dot. The result is that the stair-stepping effect on curves or slanted lines—often referred to as "aliasing" or "the jaggies"—is all but eliminated with RET.

Should you decide you need still more flexibility or broader software support, you can add PostScript to your IIISi. This \$895 option must be installed by a dealer and requires a \$169 investment in 1MB of RAM (for a total of 2MB). A total of 4MB is required for duplex PostScript printing. HP also has plans to start shipping a version of the printer with factory-installed PostScript later this summer; with 2MB of memory and PostScript, the printer will carry a list price of \$6,595. The PostScript option is genuine Adobe and comes with the standard 35 font out-

The first job is stacked all the way to one side of the bin. When the next job starts, the mechanism moves an inch to the other side and stacks the output in this new area. For the next job, the stacker moves back over an inch, and the pages line up with the first job. This makes it easy to identify where each job starts and stops, even if there are no banner pages separating them.

Although the IIISi has two paper trays (like the LaserJet IIID), the base-priced model does not do duplex printing. For \$695, you can purchase the duplex printing tray, which fits entirely within the base of the printer. Almost anyone should be able to install the option in about 5 minutes by following the diagrams and instructions. All you have to do is remove the six screws, two case parts, and piece of metal; slide the duplex tray in place; and replace the removed parts. There are no cables to route, no complex alignments to struggle with. Just slide the tray into place and you're done.

There is, however, one paper-handling omission: There is no provision for 11-by

17-inch paper. You can print legal-size (8.5- by 14-inch) paper with the optional \$129 legal-size paper trays.

FONTS AND OTHER FEATURES

Too many printers in the past have demonstrated that all the features in the world can't help you if your programs cannot take advantage of them. The IIISi is careful to avoid this trap.

To start with, the printer is based on the same PCL 5 printer language that helped make the LaserJet III a big hit in the market. A superset of the command language used by the original LaserJet, PCL 5 offers a variety of advantages. Perhaps the flashiest feature of PCL 5 is scalable font support—a feature that used to be unique to Adobe PostScript and its clones. The IIISi includes the same Courier and Line Printer bitmapped fonts as earlier LaserJets did, but it also has four families of scalable font outlines: CG Times, Univers, Univers Condensed, and Zapf Dingbats. The first three fonts come in medium, medium italic, bold, and bold

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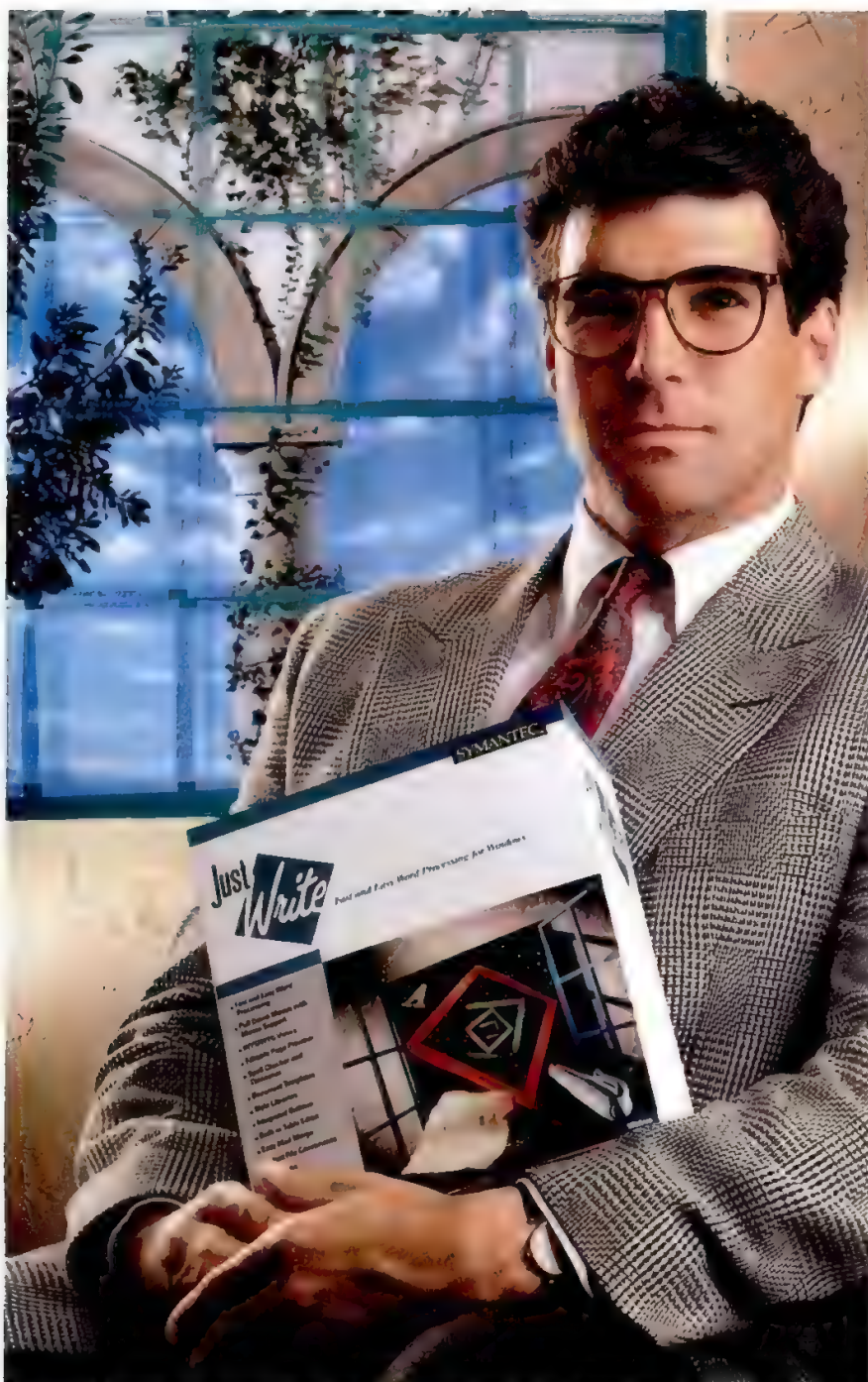
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PRINTERS

HP LASERJET IIIiSi

lines. And unlike HP's PostScript options for other printers, this one lets you switch between the PCL 5 and PostScript command languages by using software commands.

EASY TO OPERATE

In order for a shared printer to be successful in a typical office environment, it must be easy to set up and maintain. The IIIiSi is just as easy as the III to install. The process is made even easier, thanks to a separate "Use Me First!" booklet that provides clear illustrations and simple step-by-step instructions. There is also a good troubleshooting section, complete with HP's technical support phone number (208-323-2551) and hours (7:00 to 6:00 M.S.T.) prominently displayed. If you have ever set up a LaserJet before, you are not likely to encounter any problems with the IIIiSi.

The front-panel controls, the same as on the III and IIID, are raised and have lighted switches and a single-line LCD message window. The menu system for configuration is easy to use, especially with the operating manual's illustration of the menu options. It would be even

The IIIiSi uses a single drum/toner cartridge like its smaller LaserJet relatives and has paper trays similar to the LaserJet III and IIID. There are some important differences, however. The drum/toner cartridge costs more: \$169 list. On the other hand, the cartridge is rated at 8,000 pages—twice the rating of the LaserJet III cartridges—which results

in a low 2 cents per page for consumables. The IIIiSi toner itself is also different; HP describes it as microfine because it is made of smaller particles. This is designed to give better images in conjunction with the RET, which provides finer resolution. The print engine is rated for a 50,000-page-per-month duty cycle.

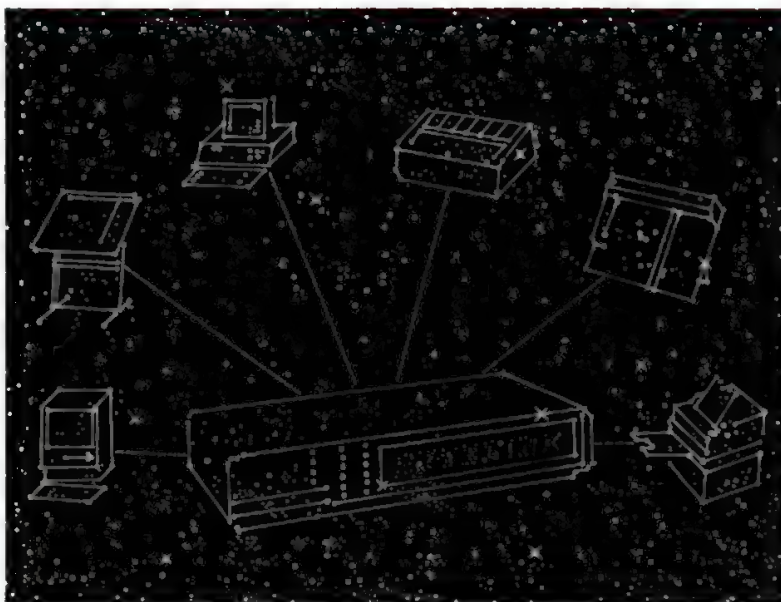
Each of the two 500-sheet (one-ream) paper trays holds more paper than those of the LaserJet III or IIID. You can also

If you've ever set up a LaserJet, you are not likely to encounter any problems with the IIIiSi.

easier with a two-line display (like Lotus 1-2-3's menu display), so you could see more information about your options, but the IIIiSi's is still fairly easy to use.

Even fairly advanced tasks such as upgrading the printer's memory are made simple. The IIIiSi uses industry-standard SIMMs, and you can install combinations of 1MB and 4MB modules to add to the base-priced model's standard 1MB of memory. You can add memory for configurations that range from 2MB to 17MB of total memory simply by removing a side panel and popping in the SIMMs. This is a marked improvement over earlier LaserJets, which require expensive proprietary memory expansion cards.

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KODAK EKTAPLUS 7016: A Multifunction Solution for Multiuser Printing

by Alfred Poor

Kodak's new \$5,495 Ektaplus 7016 printer takes a different approach to multiuser functionality than the HP LaserJet IIISI does. Providing a text speed of 16 pages per minute and 6-ppm convenience copying, the Ektaplus is one of the first multifunction peripherals available. Where the HP printer starts with a simple base model and lets you add features as needed, the Kodak design integrates many options from the start. The end result is a printer that is better suited for sharing than the IIISI, though the IIISI has some advantages in terms of performance, print quality, and network-support flexibility. (See "Kodak's \$5,500 Hydra Combines Workgroup Printing and Convenience Copying," First Looks, *PC Magazine*, March 26, 1991.)

The 7016 starts with a 16-ppm engine, which uses an LED array to produce 300-dot-per-inch resolution. Because it uses "write white" technology, text looks a bit thinner than that produced on a Canon-engine laser printer. There is no equivalent to the IIISI's Resolution Enhancement Technology, so the 7016's curves and diagonal lines are not as smooth. The printer uses separate toner and a flexible photosensitive drum. Toner refills cost \$130 and are rated for 4,000 pages, making it a bit more expensive to operate than the IIISI: 3.2 cents per page for Kodak toner alone is over a penny more than the 2 cents for the HP toner and drum combined. Two 250-sheet input trays offer plenty of paper, and you can choose either faceup or facedown output, though you must



The \$5,495 Kodak Ektaplus 7016 is a 16-ppm shared printer with a built-in 6-ppm convenience copier. Unlike the HP LaserJet IIISI, the 7016 allows multiple ports to be active simultaneously. Options for the 7016 include an AppleTalk port; options for the IIISI include Ethernet and Token-Ring connections.

move a paper tray to make the switch; with the IIISI, this switch can be handled through software. The Kodak does not offer duplex printing, which is an option for the IIISI.

The printer is multilingual, as it can speak HP-PCL Level 4 (the LaserJet

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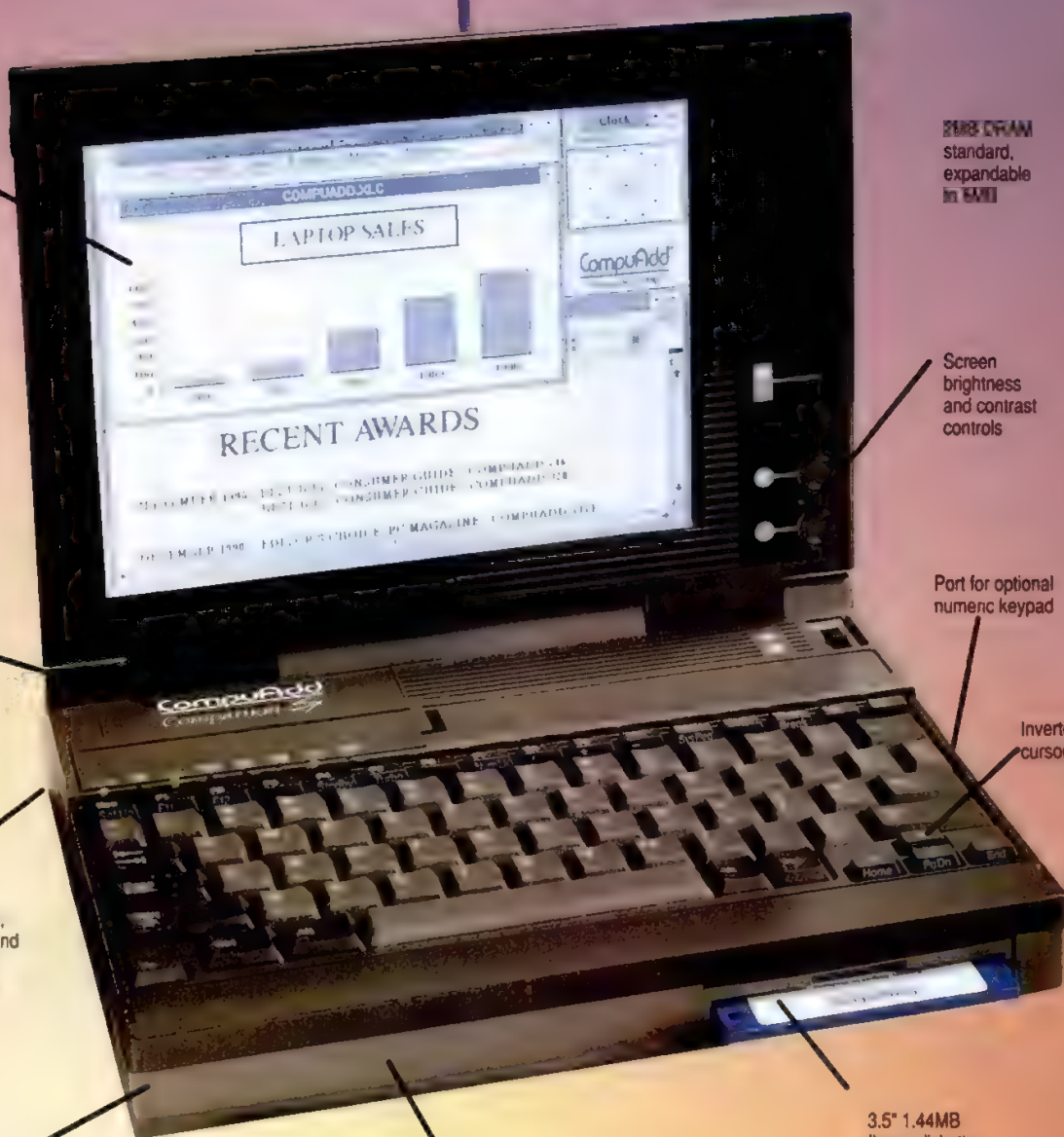
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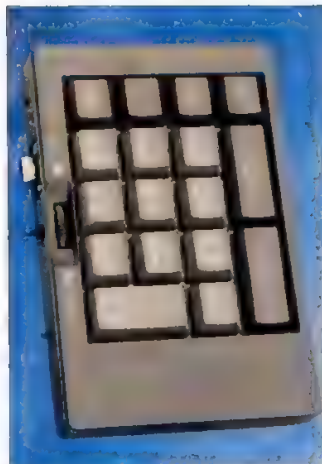
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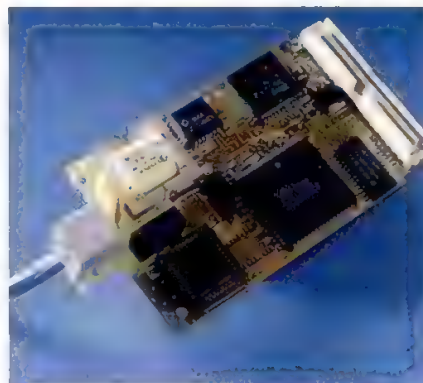
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PRINTERS

HP LASERJET IIISI

II-compatible language), HPGL, Epson FX-80, IBM Proprinter, and Diablo 630. For \$1,995, you can add a PostScript option to the 7016 (PostScript is factory-installed on the Ekta-print 7016PS). The 7016 comes with one parallel and one serial port as standard. Unlike most printers with multiple ports, both are simultaneously active—a built-in printer-sharing feature. You can even configure the ports for different emulations; for example, you can define the parallel port for a LaserJet emulation and the serial port for the IBM Proprinter. The IIISI also comes with a parallel and a serial port, but only one can be active at a time.

With the 7016, you can add up to two interfaces, for a total of four. The new ports may be any combination of the \$95 parallel, \$95 serial, and \$195 AppleTalk interfaces (AppleTalk requires the PostScript option). The IIISI also offers optional network printer interfaces: \$695 for Ethernet and \$795

for Token-Ring. (Multiple ports and other sharing options are available for the IIISI from third-party manufacturers, such as Extended Systems of Boise, Idaho (208-322-7575).)

In addition to being a shared printer, the Kodak Ektaplus 7016 doubles as a 6-ppm "convenience copier." You lift the lid and place an original on the 8.5-by 11-inch glass copier table, then press the start button. The printer is intelligent enough to buffer a pending print job, make the copies, and then return to printing. The copies are produced by an optical process, as opposed to a digital scanning approach.

The printer turned in expected performance times on PC Labs' tests. In LaserJet emulation mode, the 7016 clocked 14.5 ppm on the Text Speed test and managed 11.0 ppm in PostScript; these are a bit slower than the 15.0- and 14.5-ppm times produced by the IIISI in PCL and PostScript modes, respectively. But the 7016 had some

difficulty with the nested-macro portion of the LaserJet-emulation compatibility test.

With a base price the same as the HP LaserJet IIISI, the Kodak Ektaplus 7016 offers a different combination of features based on a different design philosophy. You get printer-sharing features and a built-in convenience copier, but the Kodak Ektaplus 7016 doesn't have as many expansion options as the IIISI. ■

Kodak Ektaplus 7016

Kodak Ektaplus 7016PS

Eastman Kodak Co., 901 Elmgrove Rd., Rochester, NY 14653; 800-344-0006.

List Price: Model 7016, \$5,495; Model 7016PS, \$6,995. **PostScript upgrade,** \$1,995; **2MB upgrade,** \$499; **parallel or serial port,** \$95; **AppleTalk port,** \$195. **Dimensions (HWD):** 15.5 x 23.5 x 19.7 inches. **Weight:** 85 lbs.

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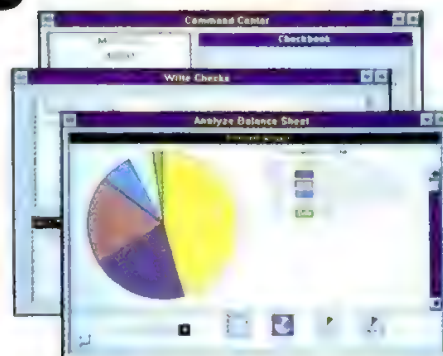
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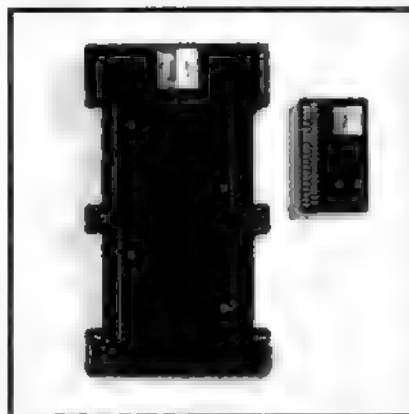
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PRINTERS

HP LASERJET IIISi

configure the IIISi so that when one tray empties, the printer switches to the other tray. It also uses a simple paper path that is easy to clear in the case of a jam, though we did not encounter any paper problems in the course of our testing.

SETTING THE MARK

Taken in total, the HP LaserJet IIISi sets a new standard against which all newcomers will be judged. The base-priced model could sell with a street price as low as \$3,600 if discounted by about the same percentage as the other LaserJet III family members. A fully loaded model with PostScript, 4MB of extra memory, duplex printing, and a network interface lists for about \$8,500, which should translate to around \$5,600 on the street. That's a lot of printer for the money.

There are those who believe that the most cost-effective and efficient solution is still to place a single-user printer on each user's desk. Contributing editor Jim Seymour makes a strong case for this strategy in his column in the April 16, 1991, issue of *PC Magazine*. The purchase and operating costs of the IIISi are so attractive, however, that the economics

make it mighty tempting. If you buy three LaserJet III printers at a street price of \$1,600 apiece, for a total of \$4,800, you get 750-sheet paper handling and three 8-ppm print engines with consumables that

A fully loaded IIISi
with an \$8,500 list
price should sell for
\$5,600 on the street.

cost more than 3 cents per page. A IIISi that can serve the same three users—or more—will cost around \$3,600: a purchase savings of up to \$1,200. And the fact that you will save a penny for every page you print with the IIISi means that the savings will continue to grow.

The IIISi, with its low base price, full range of options, broad industry support,

and excellent speed and print quality, is the pace setter in this contest and promises to be exciting. But how long HP can hold this early lead remains to be seen; products have been announced, have been released, or are expected shortly from IBM, Kodak, QMS, and Texas Instruments, and there are surely others waiting in the wings. You can count on a full rundown on the new breed of shared printers in *PC Magazine's* eighth annual special issue on printers this fall. ■

Alfred Poor is a contributing editor of *PC Magazine*.

HP LaserJet IIISi

Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; 800-752-0900. **List Price:** With PCL 5, 1MB RAM, \$5,495; with PostScript upgrade, 2MB RAM, \$6,595. PostScript upgrade, \$895; envelope feeder, \$495; duplex printing tray, \$695; legal-size paper tray, \$129; 1MB SIMM, \$169; 4MB SIMM, \$499; Ethernet expansion interface, \$695; Token-Ring expansion interface, \$795. **Dimensions (HWD):** 16.5 x 21.6 x 23.2 inches. **Weight:** 123 lbs.

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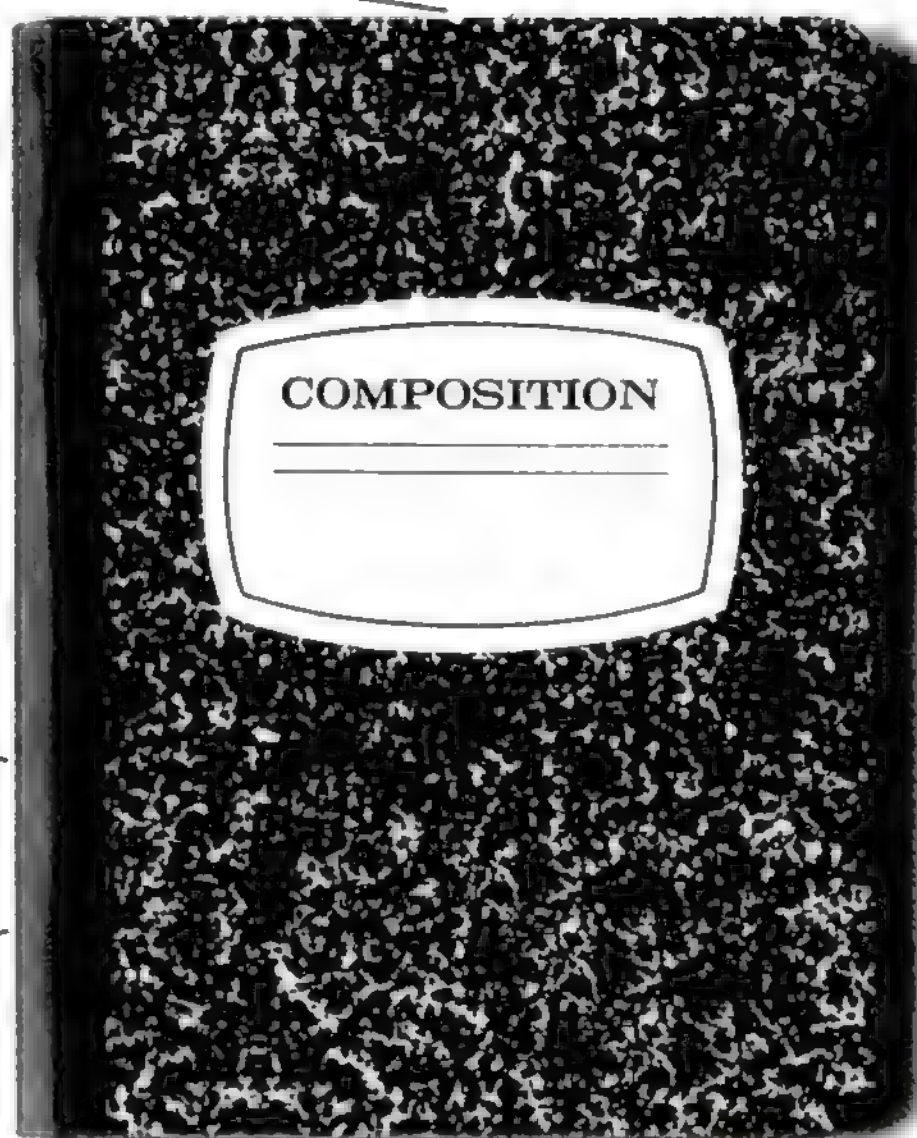
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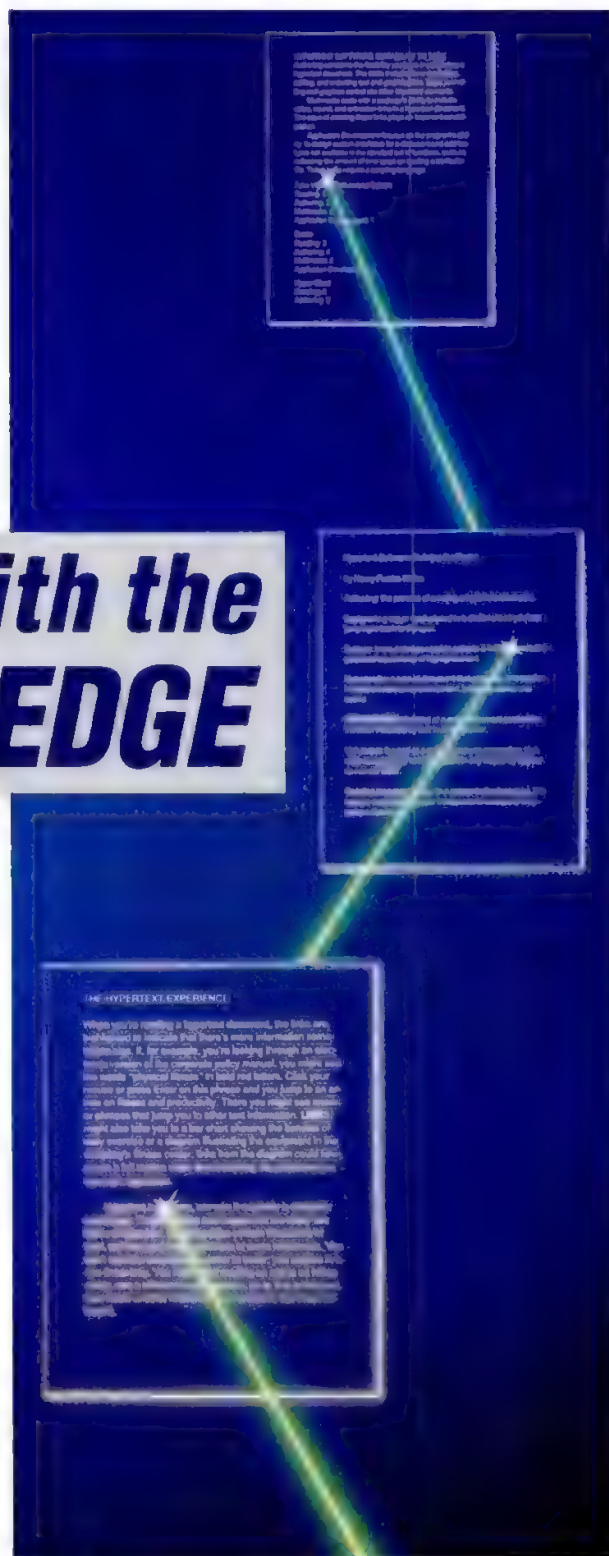
Hypertext documents are interactive, automatically taking you to the exact information you want regardless of the format or application. These eight packages are the tools you use to set up your documents.

3-D Reading with the **HYPertext EDGE**

by Henry Fersko-Weiss

The idea of hypertext is simple: You link related information together, regardless of its location and medium, and links lead to other links in a nearly endless chain from text to graphics to video to applications and back again.

Leaping through information this way makes reading an interactive, three-dimensional activity. As the author of such a document, you can build connections between ideas, give information many structures at one time, and enter hidden asides. As the reader, you choose which details to look at and which tangents to follow. You may feel like Alice in Wonderland opening the door in a sitting room and stepping into an enchanted forest, then opening a door in a tree and walking right into the Queen of Hearts' rose garden.



The advantages of linking are obvious. You know when more information on a subject exists without hunting through an index or doing a search, and you can move to the information instantly. Best of all, the access is transparent; you don't need to know what file or application the information is in.

There are a great many ways in which associative linking or nonlinear writing and reading can be used. Today, you can find hypertext links in on-line help systems (like that of *Microsoft Windows*), personal information managers, text retrieval systems, expert systems, and application generators (see the sidebar "The Hypertext Universe"). But the programs that use hypertext fully are authoring programs designed to create electronic manuals, training courses, and other large text-based applications. The eight products we evaluate here, priced from \$89 to \$695, are the most commonly available and represent the full range in functionality, from simple text compilers to packages with graphics formatting, automatic indexing, and links to full-motion video, digitized sound, and animation.

THE HYPERTEXT EXPERIENCE

When you're reading a hypertext document, the links are highlighted to indicate that there's more information somewhere else. If, for example, you're looking through an electronic version of the corporate policy manual, you might see the words "physical fitness" in bold red letters. Click your mouse or press Enter on this phrase and you jump to an article on fitness and productivity. There you might see words or phrases that jump you to other text information. Links might also take you to a bar chart showing the benefits of daily exercise or a diagram illustrating the equipment in the company's fitness center; links from the diagram could take you to a full-motion video demonstrating the proper way to use each apparatus.

Hypertext is not new, nor was it originally a computer technology. Encyclopedias and magazines are really two forms of hypertext. Encyclopedias contain thousands of brief, well-focused articles with lots of cross-references. You don't read the encyclopedia cover to cover; you browse in a nonlinear way. You might start reading an article on horse racing, see a reference to Secretariat, go to that article, and then follow another reference to an article on Churchill Downs.

Magazines often have articles within articles—something akin to exposed links. You might be reading a story on mutual funds that references a boxed story on the ten best performers over the last five years. Many magazines also have one-subject special issues that contain a number of related stories with cross-references, boxes, diagrams, and photographs. The difference between encyclopedias, magazines, and true hypertext documents is the ability to make the links automatic, to have a variety of links, and to cross communication mediums.

COMMERCIAL USES

Most of the work on hypertext has been done in university research laboratories.

Some of the first PC-based hypertext authoring programs, such as *Guide* and *Hyperties*, came out of these academic experiments. Commercial authoring programs started appearing in 1987, the same time that Apple Computer released *HyperCard*. Although *HyperCard* is an application generator and not an authoring system, it popularized the use of hypertext.

Since hypertext was a new way of thinking for most people, the market for authoring systems developed slowly, but it has picked up steam. According to a study done by Market Intelligence Research Corp., the U.S. 1987 market for authoring programs was about \$1.6 million. By 1993, sales are projected to reach 1.8 million packages yielding \$485 million in revenues.

Today's authoring programs are used



EDITORS' CHOICE

• HyperWriter

One hypertext authoring package has the best mix of power, flexibility and ease of use: *HyperWriter*, \$395 from Ntergaid. With *HyperWriter* you can design appealing hypertext documents that use colored backgrounds, colored text, screen accents such as borders and frames, logos, and text graphics. You can build a document on the page or screen metaphor, or as one long text file.

Nearly every type of link is available in the package, from various kinds of text links to graphics, video, and digitized sound. It provides assisted linking, gives you control over the appearance of the link anchor, and has buttons in six different visual styles that can perform links or take the reader to a note facility, a history of reading, or other functions you've created with the program's scripting language. *HyperWriter* also has a good set of basic text-editing features, including a spell-checker.

On the reading side of the equation, the package is just as outstanding. You have the right to distribute as many runtime versions of the program as you like, and readers get extensive navigational tools such as the ability to call up a graphics map of links in the

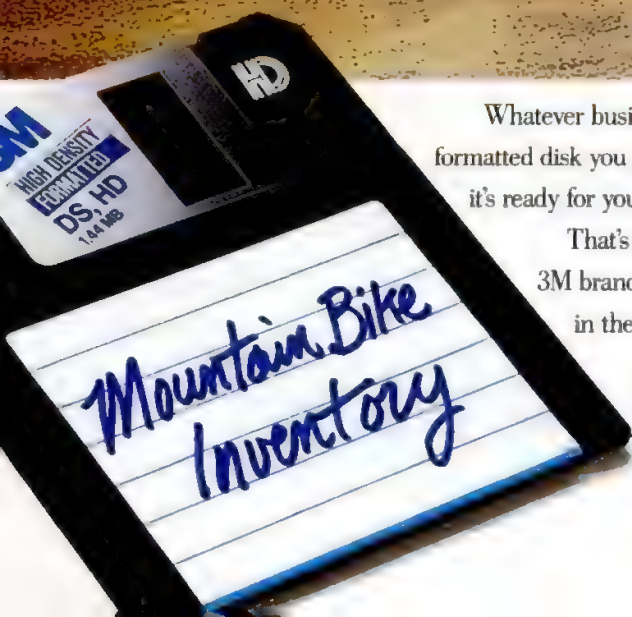
document, see a reading history, tag files, and leave a bookmark. *HyperWriter* also has good Boolean search capability.

Honorable mention goes to a package close to *HyperWriter* in functional richness: OWL International's *Guide*. This *Windows* application has superior formatting capabilities, and you can use any number of text fonts (it comes with 9) and 11 different point sizes. In addition to coloring and styling text to indicate links in a document, the package uses cursor icons that change depending on the type of link. You also get very good control over graphics in *Guide*. You can combine images, resize them, and place them anywhere on the screen.

Guide's navigational tools, however, need some improvement. You can't jump back automatically to a link anchor that started a chain of jumps, nor can you leave bookmarks, call up a map of links, or see a reading history. *Guide* also lacks support for digitized sound and animation. The package's biggest drawback is its substantial cost. The authoring package costs \$495, and after the first \$49.95 runtime version, each of the first 100 reading packages costs \$95.



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SOFTWARE HYPertext

to build some very complex applications. For example, *HyperWriter* was used to create an electronic service and repair manual for the antiradar system on the B1 bomber. On paper, the document took up about 4,000 pages and 9 feet of shelf space. When the hypertext version was put onto one CD-ROM, it linked together text, graphics, and full-motion video showing repair routines.

Hyperties was used to create a multimedia museum exhibit on the Holocaust for the Museum of Jewish Heritage in New York City. It includes 3,000 articles and 10,000 videodisk images linked by subject and accessed by a touch-sensitive screen.

The most popular uses of authoring programs are for manuals, training systems, university courses, sales support systems, catalogs, research libraries, and so on. All these applications have at their core large amounts of information and can benefit from including other media.

HOW THEY WORK

Hypertext products contain two parts: an authoring program and a separate reading or runtime program for large-scale distribution of a document.

Most authoring programs let you write documents using internal text editors—of varying sophistication—or let you import documents written in your word processor. With your own word processor, you can employ features that may not be part of an authoring program. For example, only *Hyper-Word* and *HyperWriter* have a spell-checker, and none of the authoring programs have a thesaurus.

Your own word processor may also make tabs, block operations, and search-and-replace routines easier or let you perform massive formatting operations with macros. The more sophisticated hypertext programs—or those like *Trans-Text* and *Hyper-Word*, which are fundamentally word processors—do include most of the important editing functions. With these programs you can work on documents at any time without having to step out to your word processor and reimport a file, as you do with programs like *xText* and *SmarText*, which don't let you do any real editing.

When it comes time to put links in a document, there are almost as many approaches as there are products. In *Trans-Text* you simply type the name of the file you want to jump to, followed perhaps by a screen or line number or specific word.

You surround this information with angle brackets. The reader sees the link anchor exactly as it's entered. In *Hyperties* you mark the start of a link by putting tildes before and after the word or phrase.

When you're finished marking link starts, you resolve them by indicating whether the link words are the title of an article or are synonyms for article titles. The reader of a *Hyperties* document sees the link anchor without the tildes but in a different color. In *HyperWriter* you have to mark the text that serves as the link anchor, decide whether it is a text, graphics, or action link, choose the subtype of link (jump text link, for example) from a dialog box, and then pick the general destination, like a new window. Finally you mark the target text and press Esc to connect the two ends. The link anchor will

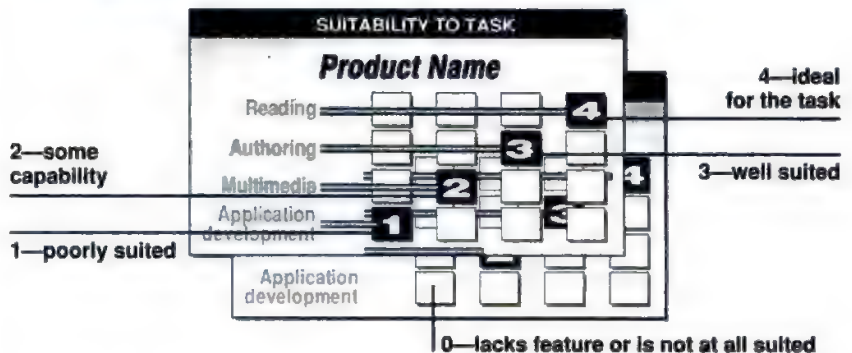
have green triangles at either end pointing left and right.

Hypertext programs also vary in the control they give you over the look of a document. For some, design stops at setting text margins, but others let you do almost anything. The two best examples of this are *HyperWriter* and *Guide*. In both programs you can design your own interface. *HyperWriter* lets you put buttons on the screen in six different styles. These buttons can be used to start a predefined tour through the information, link to a map, enter notes, review where you've been in the document, and so on. You can also choose colors for all areas of the screen, embed fancy graphics titles, and add frames to the screen. *Guide*, a Windows application, goes further because it lets you work with fonts and point sizes, control the look of a link anchor, and even change the cursor appearance depending



HYPertext SOFTWARE: SUITABILITY TO TASK

Hypertext packages have a wide array of features for building and distributing documents with links to text, graphics, and other types of information. *PC Magazine's* suitability-to-task ratings provide one way to help you rate the main areas of functionality in these programs. These informed though subjective ratings, using a scale from 0 to 4, are presented along with each review and translate as follows:



The rating for **Reading** indicates the comfort and ease of use of the interface in the reading program or runtime version of a hypertext authoring package. It also considers the flexibility in changing colors, attaching notes, and rearranging views of the information. Most importantly, it takes into account the tools for navigation and searching.

Authoring considers the flexibility you have in structuring a hypertext document. The tasks included here are linking, editing, and importing text and graphics files. Text formatting and graphics control are other important elements.

Multimedia deals with a package's ability to include video, sound, and animation links in a hypertext document. The ease of creating these links plays an important consideration.

Application development focuses on the program's ability to design custom interfaces for a document and add features not available in the standard set of functions, such as indicating the amount of time spent on reading a particular file. These tasks require a scripting language.

Before you run out and spend five or six thousand dollars for a 386SX notebook PC, we seriously suggest you take a close look at Samsung.

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Processor	16MHz 386SX	20MHz 386SX
Dimensions	8.5" x 11" x 2.1" 7 lbs.	8.5" x 11" x 2.2" 7.5 lbs.
Display	VGA Sidelit CCFT Paper White VGA LCD 256KB Video RAM 64 grey shades support	VGA Edgelit LCD 16 grey shades support
Keyboard	Standard AT-compatible 3mm key travel depth	Enhanced keyboard 2.5mm key travel depth
Memory	1MB expandable to 5MB	2MB expandable to 10MB
Software Incl.	Laplink III MS-DOS Windows 3.0	Not available
Support	Toll-free 800 number On-line modem support	Not available
Price	20MB - \$3999 40MB - \$4499	30MB - \$6499 60MB - \$6999

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No one knows more about the fine art of disc drives than Seagate. For complete product specifications, contact your authorized Seagate distributor, or call Seagate directly: 800-468-DISC, or 408-438-6550. But don't delay; like their name, these drives are bound to go fast.



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on the type of link you're on.

Both *HyperWriter* and *Guide* have a script language for doing the more complex designing. Using these languages isn't easy; you must learn the commands and think like a programmer. But for the effort, you get tremendous flexibility in the look of a document.

There are two main approaches to the structure of a hypertext document: long files (with thousands of words) and short information blocks (usually a page or

Hypertext documents should be tightly focused and concise.



screen, and not more than a few pages). Some applications seem better suited to one approach or the other, but this is also a philosophical issue. Some people insist that electronic information is only digestible if it is presented in idea-size blocks. This is clearly the bent of *Folio VIEWS*, which limits a file to 10K. Regardless of the approach you decide to take, everyone agrees that hypertext documents should be tightly focused and generally shorter than paper documents. They also will tell you that structure and design are important in determining just how readable a document is.

FULL SPEED AHEAD

A hypertext reader or runtime version of the authoring tool is nothing more than the final document with all its links and some tools for reading through it. The better the navigational tools, the more efficiently a document can be read. The very simplest readers, such as the one from *xText*, only let you go backward and forward through the links one at a time and jump to the very first page. Your cursor will jump from link to link, so there's no hunting around for the anchor points. The system is idiot-proof. Even if a reader has never used a computer before, it takes just minutes to learn how to read a document.

The more advanced reading programs give you any number of other navigational

techniques to let you get to the information you want more quickly and give you a way back to any point along the reading path. These tools include the ability to see a map of all the links, to tag files or leave bookmarks, and to get a reading history showing where you've been in your last 20 or more jumps.

Readers may also be able to interact with a document to some extent. For example, in *TransText*, *SmarText*, *HyperWriter*, and a few others, readers can attach notes to a document. A couple of packages, such as *Folio VIEWS*, let readers create their own views of the information on the fly.

THE FUTURE

Hypertext packages are becoming more and more sophisticated. They are likely to continue adding navigational tools and formatting capabilities. As the graphical user interface takes firmer hold on our PCs, we will see more programs take advantage of the freer and richer design possibilities in that environment. And now that Microsoft will be including multimedia support in the next version of *Windows*, we will see more widespread support for hypermedia functions in authoring packages.

Linking is also bound to improve. In the universities where hypertext was born, experiments with new types of links are under way. For example, links may some day be conditional, depending on who you are, what parts of the document you've previously read, or how long you've been reading.

Some manufacturers are also working to incorporate artificial intelligence techniques in authoring programs. *SmarText* began this trend by performing automatic links on a document without any input from the author, except for the degree of linking that should be done. There are problems with this approach—you can end up with lots of links you don't want—but manufacturers are smoothing out the bugs.

In the meantime, most of the packages here can do a good job of building a hypertext document. When picking a product, you should first consider how important multimedia ability and advanced formatting are to you. After that, consider how easy the program is to learn and to use, and evaluate the navigational tools in relation to how experienced your

reading audience will be. Does the program force you into a particular structure? How easy is it to edit a document?

Today's products are still in the infancy stage, but the more experienced you are at writing hypertext documents, the easier it will be to take advantage of improvements when they come. All eight of the packages we've evaluated can help you get that experience.

Folio VIEWS Professional Edition

To take full advantage of *Folio VIEWS Professional Edition*, you'll have to think about information structure. This advanced authoring and distribution program from Folio Corp. is based on a theory of electronic information structure, which is explained in an accompanying 141-page book. A separate reference guide covers procedures for creating links, converting files, and conducting word searches. The \$495 *Folio VIEWS*, Version 2.0, is a single-user version with full authoring and reading capability. The \$695 *Professional Edition* includes the runtime version of the program's reader for unlimited distribution.

Your freedom to create hypertext links with the package is extensive, including links to text within or across documents, and to graphics, other applications, video-disk, digitized sound, and animation. It offers excellent search capabilities that index on literally every word. Full indexing is complemented by file compression techniques that reduce a file with the index to half its original size or less. This utility makes *Folio VIEWS* great for use with a CD-ROM application. The program relies on features and commands that are easy to learn, but it is weak in navigation, editing, and graphics manipulation.

CREATING THE FOLIO STRUCTURE

A *Folio VIEWS* document is called an "infobase," meaning that information—text, graphics, sound, and animation—is

SUITABILITY TO TASK				
<i>Folio VIEWS Professional Edition</i>				
Reading	☐	☐	☒	☐
Authoring	☐	☐	☒	☐
Multimedia	☐	☒	☐	☐
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SOFTWARE

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 - 7928 □ Adobe Plus Pack 129
 - 8367 □ ATM & Plus Pack Bundle 189
 - 7392 □ Adobe PostScript Cartridge 319
- (Entire Adobe Type Library, from 1 to 194 is available. Call for more information.)

Aldus ... NCP

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Alpha Software ... NCP

- 5104 □ Alpha Four 1.1 319.

Application Techniques ... NCP

- 1214 □ Pizazz Plus 2.0. 69.
- 9621 □ Picture Eze 1.0 for Windows 99

Ashton-Tate ... NCP

- 4450 □ dBASE IV 1.1 499.

Asymetrix ... NCP

- 7384 □ Toolbook 1.0 for Windows 309.



Adobe Systems ... NCP

- 9623 □ Adobe TypeAlign 1.0 for Windows—Provides customized text-manipulation, compatibility with graphics & drawing applications. Create distorted, perspective & curved type with mixed typefaces, styles & sizes. Requires ATM for Windows \$69.



Microsoft ... NCP

- 2856 □ Excel 3.0 for Windows—Now the best Windows spreadsheet just got better! New features make it even more powerful and easier to use than ever.

Version 3.0 enhancements include Autosum & Best Fit to make building spreadsheets easier, faster linking of multiple worksheets, solve multiple variable equations for what-if analyses, and run macros easier by creating a button on your worksheet. It also includes a more powerful forecasting feature. Just change a chart point and the underlying worksheet is automatically updated. You can also easily create style templates and add clip art to your spreadsheets.

More powerful graphics, dynamic linking between other Windows programs, and additional help and file compatibility for anyone familiar with Lotus 1-2-3, makes this a must for any serious Windows user. \$329.

Atech Software ... NCP

- 9436 □ Publisher's Powerpak for Windows with Super Font Pack free 49.

- 9435 □ Publisher's Powerpak for WordPerfect & MS Word w/Super Font Pack free 49.

Avery ... NCP

- 6006 □ Label Pro 1.0 (Laser) 49.
- 7336 □ Label Pro 1.0 for Dot Matrix 49.

Bitstream ... NCP

- 7568 □ FaceLift 1.0 for Windows 2.x/3.0 59.
- 8040 □ FaceLift for WordPerfect 5.0/5.1 59.
- 7569 □ Companion Value Pack 1.0 125.
- 8883 □ Type City Cartridge with Deli 259.
- Typeface Packages each 89.

Bloc Publishing ... NCP

- 1447 □ Form Tool Gold 3.0 55.
- 9039 □ 3-D CHARTS To Go! 1.0 59.

Borland International ... NCP

- 6242 □ Quattro Pro 2.0 339.
- 1514 □ Paradox 3.5 529.
- 9635 □ Object Vision 1.0 (intro. price) 95

Broderbund ... NCP

- 1416 □ New Print Shop Companion 33.
- 1434 □ New Print Shop 39.

Brown-Wagh ... NCP

- 8579 □ MicroLogic More Fonts 2.0 75.

ButtonWare ... NCP

- 6419 □ PC-File 5.01 89.

Caere ... NCP

- 6004 □ Omnipage 386 3.0 489.

Central Point ... NCP

- 5039 □ PC Tools 7.0 115.
- 8114 □ Backup 7.0 84.

Checkfree Corporation ... NCP

- 6360 □ Checkfree 19.

Chronologic Corp. ... NCP

- 8849 □ Instant Recall 1.2 64.

CompuServe

- 7546 □ DOS Membership Kit 1.2 23.

Concentric Data Systems ... NCP

- 6575 □ R & R Relational Report Writer 4.0 159.

Corel Systems ... NCP

- 5506 □ CorelDRAW! 2.0 389.

Data Storm ... NCP

- 4798 □ PROCOMM PLUS 2.0 69.

DCA ... NCP

- 5611 □ Crosstalk for Windows 1.1 125.

Delrina Technology ... NCP

- 4325 □ PerFORM 2.1 95.
- 7351 □ PerFORMPRO 1.0 for Windows 274.

Digital Research ... NCP

- 8288 □ DR DOS 5.0 145.

DMA ... NCP

- 8378 □ PC Anywhere IV 4.02 105.

Fifth Generation Systems ... NCP

- 7725 □ Direct Access 5.0 65.
- 3950 □ Fastback Plus 2.1 119.

FormWorx ... NCP

- 5810 □ FormWorx with Fill & File 2.5 85.
- 7311 □ Form Publisher for Windows 1.2 139.

Fox Software ... NCP

- 6188 □ FoxPro 1.02 459.

Funk Software ... NCP

- 7380 □ P.D. Queue 1.0 (print spooler) 59.
- 2228 □ Sideways 3.3 59.
- 9488 □ Sideways & P.D. Queue 85.

Geoworks ... NCP

- 8789 □ Ensemble 1.0 129.

Great American Software ... NCP

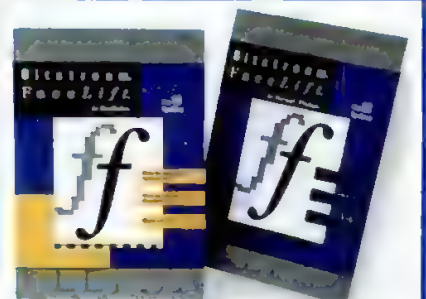
- 4880 □ One Write Plus Acct. Sys. 2.06 189.

Hayes ... NCP

- 7983 □ Smartcom Exec 2.0 79.
- 9639 □ LANstep 1.0 (to be released 4/91) 349.

hDC Computer Corp. ... NCP

- 8974 □ Icon Designer 1.0 35.
- 7389 □ Windows Express 3.0 52.
- 7383 □ First Apps 1.0 52.



Bitstream ... NCP

- Fast and easy to use, FaceLift scales printer fonts to any size. Includes 13 typefaces to give you professional documents instantly.
- 7568 □ FaceLift 1.0 for Windows 2.x/3.0 \$59.
- 8040 □ FaceLift for WordPerfect 5.0/5.1 59.

Or spreadsheet magic?



Funk Software ... NCP

9488 ☐ Sideways and P.D. Queue—Two great Lotus add-ins together at one great price. Print great-looking extra-wide spreadsheets and let P.D. Queue get you back to work fast by managing the printing in the background \$85.

Helix Software ... NCP

- 9627 ☐ Netroom 1.1 (single user) 52.
- 9626 ☐ Netroom 1.1 (4 user) 95.
- 9628 ☐ Headroom 2.0 65.

Hilgraeve ... NCP

- 2323 ☐ HyperACCESS/5 2.0 (DOS & OS/2) 115.

IBM ... NCP

- 6599 ☐ Current 1.1 239

Individual Software ... NCP

- 6222 ☐ Resume Maker 1.3 29.

Inner Media, Inc. ... NCP

- 8846 ☐ Wide Angle 1.0 for Windows 69.

Inset Systems ... NCP

- 7298 ☐ HiJaak 2.0 99.

- 7300 ☐ Inset Plus HiJaak 125.

Insight Development ... NCP

- 8320 ☐ PrinTools 1.0 85.

Insight Resource ... NCP

- 8851 ☐ KO-Pilot for WordPerfect 5.1 55.

Intuit ... NCP

- 2426 ☐ Quicken 4.0 39.



Corel Systems ... NCP

5506 ☐ CorelDRAW! 2.0—The PC graphics software that's fast, fun and powerful. CorelDRAW! 2.0 now comes with more drawing power, more type control, and more value...and it's still easy to use \$389.

Isogon ... NCP

- 7478 ☐ FontSpace 2.0 \$59.

LaserGo ... NCP

- 7635 ☐ GoScript Plus 3.0 189.

LaserTools ... NCP

- 6882 ☐ PrintCache 2.3 99.

Lord Publishing ... NCP

- 5191 ☐ Ronstadt's Financials 1.02 75.

Lotus ... NCP

- 5417 ☐ 1-2-3 3.1 429.

- 5653 ☐ 1-2-3 2.2 349.

- 5134 ☐ Magellan 2.0 109.

- 4131 ☐ Agenda 2.0 299.

MECA ... NCP

- 2798 ☐ Managing Your Money 7.0 139.

Micro Logic ... NCP

- 6787 ☐ Info Select 1.1 55.

Microcom ... NCP

- 7649 ☐ Virex-PC 1.1 79.

- 6234 ☐ CarbonCopy Plus 5.2 119.

Microlytics ... NCP

- 9636 ☐ Strunk & White Elements of Style 35.

- 7931 ☐ Random House Encyclopedia 68.



Atech Software ... NCP

Publisher's Powerpak & Super Font Pack Bundle—A complete font solution. Spruce up your documents with "On-The-Fly" scalable fonts. Awarded PC World's Best Buy (1/91). 9436 ☐ Windows \$49. 9435 ☐ WordPerfect \$49.

Microsoft ... NCP

- 2894 ☐ QuickBasic 4.5 69.

- 7010 ☐ Windows 3.0 99.

- 7388 ☐ Project 1.0 for Windows 459.

- 7882 ☐ Productivity Pack 1.0 for Windows 45.

- 2904 ☐ Works 2.0 99.

- 2901 ☐ Word 5.0 209.

- 7387 ☐ PowerPoint 2.0 for Windows 329.

- 6195 ☐ Word 1.1 for Windows 329.

- 2856 ☐ Excel 3.0 for Windows 329.

- 8137 ☐ Office for Windows (includes Excel, Word for Windows, and PowerPoint) 659.

- 2853 ☐ C Compiler 6.0 329.

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Central Point Software ... NCP

9751 ☐ Anti-Virus 1.0—Recognizes over 500 known and unknown viruses. Combines virus detection, removal and prevention. Includes a virus hotline, quarterly mailings, on-line support and one free update \$84.

Multisoft ... NCP

- 4925 ☐ PC-Kwik Power Pak 2.0 75.

NBI, Inc. ... NCP

- 9618 ☐ Legacy 1.1 289.

Nolo Press ... NCP

- 5122 ☐ For The Record 2.0 35.

- 2982 ☐ WillMaker 4.0 39.

PC Globe ... NCP

- 5902 ☐ PC Globe 4.0 39.

- 5900 ☐ PC USA 2.0 39.

Personics ... NCP

- 9288 Laptop Ultravision 1.0 (3 1/2" only) 49.

- 4384 ☐ Ultravision 2.0 79.

PowerUp ... NCP

- 7860 ☐ Calendar Creator Plus 4.0 45.

- 7861 ☐ Address Book Plus 3.0 49.

- 7858 ☐ Express Publisher 2.0 89.

Precision Software ... NCP

- 6600 ☐ Superbase 4 for Windows 1.2 429.

Qualitas ... NCP

- 7539 ☐ 386MAX 5.1 75.

- 7967 ☐ BlueMAX 5.1 for PS/2 (3 1/2" only) 85.

Quarterdeck ... NCP

- 6422 ☐ QRAM 1.0 54.

- 3221 ☐ Expanded Memory Mgr. 386 5.1 65.

- 3220 ☐ DESQView 2.3 85.

- 4586 ☐ DESQView 386 2.3 145.

QUE Software ... NCP

- 4155 ☐ RightWriter 4.0 54.

Reality Technologies ... NCP

- 7891 ☐ WealthStarter 1.0 39.

- 6572 ☐ WealthBuilder 1.1 145.

Reference Software ... NCP

- 4396 ☐ Grammatik IV 2.0 59.

- 7483 ☐ Grammatik for Windows 2.0 59.

Revolution Software ... NCP

- 4480 ☐ VGA Dimmer 3.0 (screen saver) 29.

Roykore ... NCP

- 8162 ☐ ABC Flowcharter 1.1 189.

Samsa ... NCP

- 5799 ☐ Ami Pro 1.2 309.

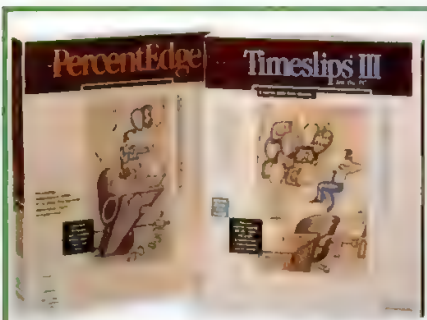
Sitka ... NCP

- 6675 ☐ TOPS Network Bundle 3.0 159.

- 3720 ☐ Flashcard 2.1 (AppleTalk netwrk. card) 155.

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TIMESLIPS ... NCP

2987 ☐ Timeslips III 4.0—Perfect for service professionals (ie. accountants, lawyers, etc.) who need to track & bill their time. . . . \$195.
6994 ☐ PercentEdge 1.0—Calculates mortgages, loans, annuities, present values, & more. . . 69.

- Softlogic Solutions ... NCP**
3542 ☐ Software Carousel 5.0 55.
Software Publishing ... NCP
9638 ☐ Professional Write Plus 1.0 175.
3482 ☐ Harvard Graphics 2.3 329.
9490 ☐ Harvard GeoGraphics 269.
Solution Systems ... NCP
7977 ☐ Brief 3.0 (Programmer's Editor) . . 189.
Spinnaker ... NCP
3478 ☐ PFS:First Choice 3.1 105.
7604 ☐ PLUS for Windows 1.0 289.
Symantec ... NCP
6397 ☐ The Norton Backup 1.2 105.
3146 ☐ The Norton Utilities 5.0 119.
3425 ☐ Q&A 3.0 239.
7999 ☐ Norton Anti-Virus 1.0 89.
Systems Compatibility ... NCP
8215 ☐ OutsideIn 1.0 65.
6564 ☐ Software Bridge 5.0 79.
9046 ☐ The Complete Writer's Toolkit 1.0 . 85.
TIMESLIPS ... NCP
2987 ☐ Timeslips III 4.0 195.
6994 ☐ PercentEdge 1.0 69.
Timeworks ... NCP
6253 ☐ Publish-It! 1.1 139.
Touchstone Software ... NCP
7420 ☐ Check It 3.0 89.



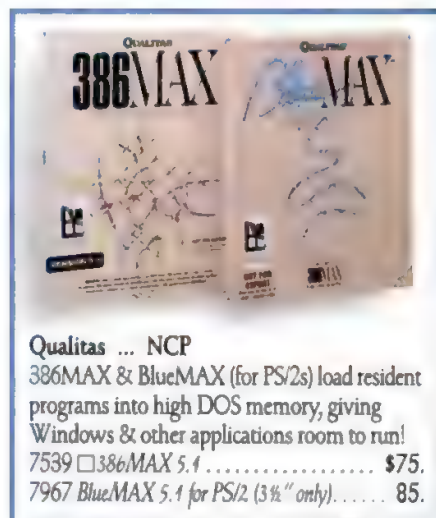
Software Publishing ... NCP

9638 ☐ Professional Write Plus 1.0—Enhanced Windows version of the top-selling executive word processor. \$175.
9490 ☐ Harvard GeoGraphics 1.0—Powerful stand alone mapping program. 269.

- Traveling Software ... NCP**
5179 ☐ LapLink III 3.0 \$95.
Ventura Software (Xerox) ... NCP
7796 ☐ Ventura Publisher for Windows 3.0 569.
West Lake Data Corp. ... NCP
7577 ☐ PC-FullBak+ 2.0 52.
WordPerfect Corp. ... NCP
7781 ☐ LetterPerfect 1.0 129.
3804 ☐ WordPerfect 5.1 265.
6685 ☐ DrawPerfect 1.1 279.
WordStar International ... NCP
6791 ☐ WordStar Prof. 6.0 219.
XTREE ... NCP
6161 ☐ XTree Gold 2.0 95.

RECREATIONAL/EDUCATIONAL

- Broderbund ... CP**
8068 ☐ Where in the World is Carmen
San Diego Deluxe Edition 52.
5851 ☐ SimCity 33.
8886 ☐ SimEarth 45.
Electronic Arts ... NCP
4534 ☐ Mavis Beacon Teaches Typing (CP) 35.
7865 ☐ PGA Golf 39.



Qualitas ... NCP

386MAX & BlueMAX (for PS/2s) load resident programs into high DOS memory, giving Windows & other applications room to run!
7539 ☐ 386MAX 5.1 \$75.
7967 ☐ BlueMAX 5.1 (for PS/2 (3 1/2" only)) . . . 85.

- Harvard Associates ... NCP**
2324 ☐ BPC Logo 3.0 59.
Microsoft ... NCP
7881 ☐ Entertainment Pk for Windows 1.0 29.
2858 ☐ Flight Simulator 4.0 42.
8270 ☐ Aircraft and Scenery Designer 1.0 29.
Microsoft Press (Books)
8129 ☐ Running Windows (2nd Edition) . . . 22.
8136 ☐ Running Microsoft Excel 22.
Penton Overseas ... NCP
☐ VocabuLearn/ce Levels I & II (French, Italian, German, Spanish, Russian, Hebrew and Japanese). each 35.
Sierra ... CP
8146 ☐ Quest for Glory II 39.
9466 ☐ Space Quest IV (VGA) 39.
7972 ☐ King's Quest V (VGA) 45.
SirTech ... CP
8235 ☐ Bane of the Cosmic Forge 39.
Software Toolworks ... NCP
4659 ☐ Chessmaster 2100 (CP) 35.
7372 ☐ World Atlas 42.
Stone & Assoc. ... NCP
5231 ☐ Phonics Plus 1.1 22.
7564 ☐ Young Math 2.2 22.



Microlytics ... NCP

Famous reference works come to the PC! Both are based on the printed versions of their namesakes.

- 7931 ☐ Random House Encyclopedia \$68.
9636 ☐ Strunk & White Elements of Style . . . 35.

- SubLogic ... NCP**
6190 ☐ Air Transport Pilot 39.
Toyogo ... NCP
7676 ☐ Nemesis Go Master Deluxe 88.
True BASIC, Inc. ... NCP
☐ Kemeny/Kurtz Math Series. each 45.

HARDWARE

Warranties listed next to manufacturer.

- American Power ... 2 years**
7108 Smart UPS 400 339.
7105 Smart UPS 600LS 469.
6811 360SX (stand-by power source) . . . 219.
7106 520ES (stand-by power source) . . . 329.
AST Research ... 5 years
1299 SixPakPlus 384k C/S/P 179.
8041 SixPak 286 0k. 99.
ATI Technologies ... 2 years
9629 VGA Wonder (256K upgradable to 512K) 199.
9619 8514/Ultra Graphics Card (512K) (req. VGA) 419.
9620 9600etc/e Modem 499.
BOCA Research ... 5 years
7001 BOCARAM/AT PLUS (0-8 Meg) . . . 119.
7061 BOCARAM/XT 0K (0-2 Meg, LIM 4.0) 99.
6998 I/O Board for AT 59.
6999 I/O Board for Microchannel (S/S/P) 109.
8380 BasicVGA (256K, 640 x 480) 69.
8381 SuperVGA (1 Meg, 1024 x 768) . . . 145.
Bravo Communications ... 2 years
7400 2 Pos. Laser Compatible Switch Box 109.
Brown-Wagh ... 1 year
8578 Creative Labs Sound Blaster 159.
Canon ... 1 year
7894 BJ-10e Printer w/free case (4.6 lb.) 349.
7897 BubbleJet Ink Cartridge (BJ-10e) . . 23.
9037 BJ-300 Printer (80 column) 549.
9038 BJ-330 Printer (136 column) 649.
CH Products ... 1 year
8119 FlightStick w/Falcon & GameCard III 79.
7345 RollerMouse (Trackball) serial 85. bus 99.
Curtis ... lifetime
1708 Ruby-Plus SPF-2 Plus 65.
7358 Command Center 89.
Glass Filter Plus (specify size) each 65.
Datadesk ... 3 years
6901 Switchboard 175.

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Hayes ... 2 years

9639 LANstep 1.0—Package includes LANstep Mail, a full featured E-mail system, and supports up to five simultaneous users. LANstep networks can grow to 128 users with LANstep Expander products (sold separately) ... \$349.

Epson ... 2 years

We are an authorized Epson Service Center.

1906	FX-850 (80 col., 264 cps, 9 pin) ...	call
1904	FX-1050 (136 col., 264 cps, 9 pin) ...	call
5183	LQ-510 (80 col., 180 cps, 24 pin) ...	call
1930	LQ-850 (80 col., 264 cps, 24 pin) ...	call
1917	LQ-1050 (136 col., 264 cps, 24 pin) ...	call
5184	LX-810 (80 col., 180 cps, 9 pin) ...	185.

Hauppauge Computer ... 1 year

9031	20 MHz 386 Motherboard for PC ...	995.
9032	20 MHz 386 Motherboard for XT ...	995.
9033	20 MHz 386 Motherboard for AT ...	995.
9034	33 MHz 386 Motherboard for AT ...	1399.

Hayes ... 2 years

2307	Smartmodem 2400 ...	349.
7391	Ultra 96 Modem ...	799.

Hewlett-Packard ... 1 year

7976	DeskJet 500 (with ink cartridge) ...	549.
6582	LaserJet IIP (with toner) ...	949.
6754	LaserJet III (with toner) ...	1699.

Intel ... 5 years

6421	2400B MNP Internal Modem ...	199.
4696	2400B Internal Modem ...	149.
5119	2400 Baud External Modem ...	179.
6420	2400EX MNP Modem ...	229.
7880	9600EX Modem ...	549.
2346	Inboard 386/PC with 1 Meg ...	495.
5336	Above Board Plus 8 2 Meg ...	549.
5342	Above Board Plus 8 I/O 2 Meg ...	569.
7782	SatisFAXtion (fax board) ...	399.
8778	SatisFAXtion for Microchannel ...	449.
8901	Matched Memory 2 Meg (PS/2) ...	189.
8903	Matched Memory 4 Meg (PS/2) ...	499.
MATH COPROCESSORS		
7385	80287XL (16 MHz 80286 CPU's) ...	199.
4750	80387SX (16 MHz 80386SX CPU's) ...	309.
2371	80387 (16 MHz 80386 CPU's) ...	349.
2372	80387-20 (20 MHz 80386 CPU's) ...	399.
4121	80387-25 (25 MHz 80386 CPU's) ...	499.

Kensington Microware ... 1 year

2582	Master Piece Plus ...	109.
7899	Expert Mouse serial ...	119.
	7900 bus ...	129.

Key tronic ... 3 years

4518	101 Plus Keyboard ...	99.
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Kraft ... 5 years

5800	3 button Thunder Joystick ...	\$29.
5813	Game Card/Thunderstick Bundle ...	55.
7862	TopTrak (Laptop Trackball) ...	75.

Logitech ... limited lifetime

7768	C9 Mouse with Windows ...	149.
6029	Trackman serial ...	85.
	6028 bus ...	89.
4297	ScanMan Plus (hand scanner) ...	165.
7975	ScanMan 256 ...	319.
8694	MouseMan (serial) ...	69.

Micron Technology ... 2 years

7595	2 Meg Expansion for HP LaserJet IIP or III ...	129.
7012	Memory Upgrade PS/2 70 - 2 Meg ...	149.

Microsoft ... lifetime

7597	Microsoft Mouse ...	89.
2897	Mouse with Paintbrush ...	105.
2898	Mouse with Windows 3.0 ...	149.

MicroSpeed ... 1 year

6007	PC-TRAC Trackball serial ...	75.
	6008 bus ...	89.
7271	Inport ...	79.
	6330 PS/2 ...	79.



Intel ... 5 years

7880 9600EX Modem—Provides ultra-fast data communications without sacrificing compatibility. Supports V.32 & V.42bis 9600 bps operation, as well as MNP Level/5 and Hayes compatible 2400/1200/300 bps modes. \$549.

Mouse Systems ... lifetime

5997	Trackball (1 yr. wrnty.) serial ...	65.
7878	PC Mouse III (bus or serial) ...	89.

NEC ... 2 years

4799	Multisync 2A (VGA Monitor) ...	499.
5085	Multisync 3D Monitor ...	689.

Orchid Technologies ... 4 years

7863	ProDesigner VGA II with 1 Meg ...	329.
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PC Power & Cooling ... 1 year

REPLACEMENT POWER SUPPLIES

3203	Turbo Cool 200 ...	149.
7915	Turbo Cool 300 ...	165.
3200	Silencer 150 (84% noise reduction) ...	115.
7053	InnerSource 2210 ...	349.

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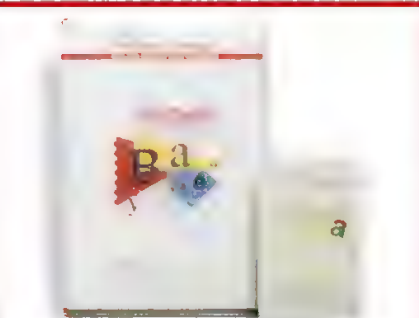


ATI Technologies ... 2 years

9619 8514 Ultra Graphics Card—Up to 10 times faster than IBM's 8514/A, transforms computer into a powerful graphics workstation. Features a dual connector design allowing use in any 16-bit ISA or MCA slot with 512K ... \$419.

Pacific Data Products ... lifetime

6779	25 Cartridges in One! (for LJ II, IIP, III) ...	275.
8816	PacificType (40 PostScript Typefaces for PacificPage PE 4.0 users) ...	275.
8975	Complete Font Library (for LJ/III) ...	275.
	Memory upgrade for LaserJet IIP/III:	
7055	2 Meg ...	169.
	7759 4 Meg ...	279.
	Memory upgrade for LaserJet II/IIID:	
6838	2 Meg ...	249.
	6836 4 Meg ...	379.
7158	PacificPage PE 4.0 (for LJ IIP/III) ...	379.
6834	PacificPage with free 2 Meg Memory Board (for LaserJet II) ...	379.
Practical Peripherals ... 5 years		
3100	1200 Baud External Modem ...	75.
3103	2400 Baud Internal Modem ...	129.
3102	2400 Baud External Modem ...	179.
8993	2400 Baud Int. Modem (V.42 bis) ...	169.
8994	2400 Baud Ext. Modem (V.42 bis) ...	209.
4542	2400 Baud Internal Modem for PS/2 ...	229.
8132	PM2400 Pocket Modem ...	109.
7934	PM9600SA Modem ...	489.



Pacific Data Products ... lifetime

8975 Complete Font Library—Provides 51 popular typestyles that can be quickly scaled by the HP LaserJet III and IIID for beautiful resolution-enhanced documents ... \$275.

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6747 Safe 400S. 399.

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TheComplete PC ... 2 years

8082 TheComplete Half Page Scanner/400

w/ReadRight Personal OCR Software 289.

6797 TheComplete Fax Portable 319.

5828 TheComplete Communicator 449.

Tripp Lite ... 2 years

6199 Isobar 4-6 (4 outlets, 6 ft. cord) . . . 49.

6200 Isobar 6-6 (6 outlets, 6 ft. cord) . . . 59.

9193 BC350 (350W Battery Backup) . . . 219.

9312 BC450 (450W Battery Backup) . . . 269.

7889 BC1200 (1200W LAN Backup) . . . 669.

Video 7 ... 7 years

5883 1024i VGA (includes 512k). 199.

4931 VRAM II VGA 512k 369.

DRIVES

CD Technology ... 1 year

8057 Porta-Drive CD-ROM 649.

8105 Installation Kit for Standard Bus. . . . 95.

8106 Installation Kit for Microchannel . . 249.



Canon ... 1 year

These ultra quiet Bubblejet printers offer dazzling print quality to rival lasers at dot-matrix style prices. Advanced paper handling capabilities.

9037 BJ-300 Printer (80 column) \$549.

9038 BJ-330 Printer (136 column). 649.

Conner Peripherals ... 1 year

8875 CP3044 40 Meg IDE HD (25 ms) . . 325.

8874 CP3184 80 Meg IDE HD (25 ms). . 499.

8876 CP3104 100 Meg IDE HD (25 ms). . 549.

IOmega ... 1 year

5116 Bernoulli II 44 Meg Internal 829.

7551 Bernoulli II Transportable 44 Meg . . 929.

5113 44 Meg Cartridge Tripak (5 1/4") . . 269.

2500 PC2B Controller 209.

Mountain Computer ... 2 years

2917 40-60 Meg Internal Tape Drive . . . 259.

5500 83-152M Int. Tape Drive 629.

5190 DC2000 Pre-formatted Cartridges ea. . 35.

6153 DC2120 Tape Cartridge (5 pack) . . 149.

Pacific Rim ... 1 year

5010 1.2 Meg External (for PS/2's) 215.

6602 1.44 Meg External (for PC/XT/AT) . . 239.

Plus Development ... 2 years

8304 Hardcard II XL 50 Meg (9 ms) . . . 399.

8287 Hardcard II XL 105 Meg (9 ms) . . . 689.

Seagate ... 1 year

2286 30 Meg Int. Hard Drive ST238R

(w/controller and cables, 65 ms) . . . 269.

4554 40 Meg Int. HD ST251-1 (28 ms) . \$269.

4624 80 Meg Int. HD 4096 (28 ms) . . . 619.

TEAC ... 1 year

4670 1.44 Meg Drive for PC/XT (3 1/2") . . 79.

4326 1.44 Meg Drive for AT (3 1/2") with

Bastech software 99.

4951 720k Drive for PC/XT (3 1/2") 69.

6951 1.2 Meg Drive for AT (5 1/4") 89.

DISKS/MEDIA

Maxell ... lifetime

2789 5 1/4" MD2-D 360k Disks (Qty. 10) . . . 10.

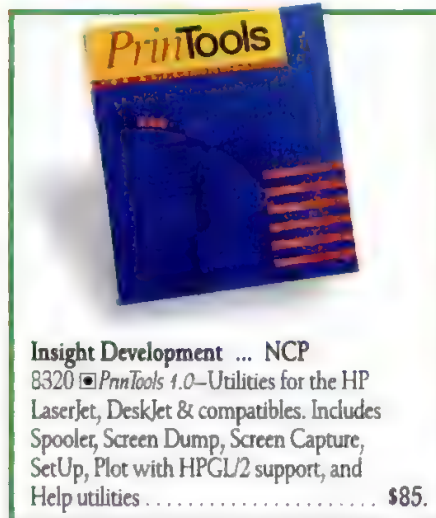
2792 3 1/2" DS/DD 720k Diskettes (Qty. 10) . 13.

2793 3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10) 21.



Plus Development ... 2 years

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3298 3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10) 19.

6148 3 1/2" DS/DD (3 Pack) 29.

6375 3 1/2" DS/HD (3 Pack) 49.

8185 QD 2040 Tape Cartridge 19.

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3944 DC 600 Tape Cartridge 29.

5679 DC 6150 Tape Cartridge 29.

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5746 1 Meg Chips (80 ns, set of 9). call

7813 256k x 4 Chips call

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nothing more than data you can group in various ways to reveal new connections and new meanings. To make this work, you must reduce information to its minimum structure: the idea. Think of ideas as information quanta, or what the program calls folios. These folios may be a sentence, a paragraph, or several pages. Like a record in a database, a folio is easiest to manage as a small chunk of information. When you create an infobase in *Folio VIEWS*, you should think carefully about the composition of your folios.

There are two different ways to build an infobase. You can use the package's text editor, or you can import files from a word processor. *Folio VIEWS* can import files from 41 different text file formats, including *Microsoft Word* 4.0 and 5.0, all versions of *WordPerfect*, *IBM DisplayWrite*, *Professional Write*, *WordStar*, *WordStar 2000*, *XyWrite*, and *MultiMate*. You can import as many files as your hard

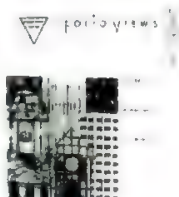
SOFTWARE HYPERTEXT

PC MAGAZINE FACT FILE

Folio VIEWS Professional Edition, Version 2.0
Folio Corp., 2155 N. Freedom Blvd., #150, Provo, UT 84604; 800-543-6546 (sales), 801-375-3700.
List Price: \$695.

Requires: 512K RAM, DOS 3.0 or later.
In Short: *Folio VIEWS* has the most consistently articulated view of hypertext structure. It breaks information into idea-size bites (folios) and then uses groups to connect them. The program has great searching, indexing, and linking facilities. It's weak on graphics manipulation, navigation, and internal editing.

CIRCLE 400 ON READER SERVICE CARD



disk can store, up to 2GB.

If you're working with imported files, you have to run them through a conversion routine that creates folios, indexes, and compresses files. You must link each imported file to a conversion method. The most common method converts every paragraph in a file into a folio. You can also design your own method to suit the information you have, such as the question-and-answer format of a legal deposition.

When the conversion is complete, you can edit the new infobase by deleting or adding folios to achieve the best presentation of ideas. The *Folio VIEWS* editor is limited to indenting, centering, justifying, and moving blocks of text. Your freedom in authoring is also limited by the way the program handles graphics. You can't combine text and graphics, alter the size or position of an image, or link from an image to more than one place in the in-

BUILDING A BETTER HYPERTEXT DOCUMENT

by Henry Fersko-Welss

Creating a good hypertext document requires that you think about textual information in new ways. You can't just take a word processing document that might represent hundreds or even thousands of printed pages and import it into an authoring program without changing its format or doing some rewriting. People don't read text on the computer screen the same way they read text on a page. They tend to get impatient with extremely long files—the boundaries of a screen are good boundaries for an idea or piece of information—nor can you just add links randomly as you move through a document.

Hypertext authoring is a very new art, so the techniques are still evolving. Here are some tips to help you get started, but use your imagination, too, and experiment with formats and with the number and kinds of links you use.

■ **All documents don't make good hypertext documents.** Ben Shneiderman, head of the Human-Computer Interaction Laboratory at the University of Maryland and a well-known figure in the hypertext world, has coined three golden rules for deciding if a document is ripe for hypertext. First, it should embody a large amount of infor-

mation organized into numerous fragments. Second, the fragments should relate to each other. Third, the user should need only a small fraction of the information at any time. If you have to read the whole thing, paper is better.

■ **Chunk your information.** Even if you're stitching together fairly long articles, try to break each longer piece into smaller bits. Subheads often make good breaking points. Each chunk should deal with one topic, idea, procedure, or technique. This aids in the readability of the document and makes it easier to layer the information in a three-dimensional structure.

■ **Simplify the language.** People will not read long, complicated expository writing on the screen. Try to convey information as simply as possible. In a good hypertext document, as in a good short story, every word and every sentence must count.

■ **Give readers as many hints as you can on where to find information.** A table of contents and a meaningful index help readers who are used to printed material find their way. And you needn't limit yourself to one contents page or index. If you can, give readers alternative pathways through the information and views. Also, if you can, give links or

files meaningful names.

■ **Link often, but not too often.** People who are just starting to author hypertext documents tend to be leery of linking. Don't be afraid to create links. There is no obvious rule for the amount of linking, but experienced authors suggest that four to six links on a screen is enough to ensure a rich, densely interwoven document without overwhelming the reader. Links should amplify, explain, illustrate, provide back-up detail, or connect related single ideas.

■ **Use the appropriate medium for the message.** Illustrations, charts, and graphs can convey a great deal of information at a glance. They give immediacy to information. And hypertext lets you do something you can't do with a printed picture: Different spots on an illustration can lead you to specific text. For example, the city names on a map might each lead to text about the city's history, industry, or nightlife. So you should always be looking for meaningful ways to present information graphically. Video and audio provide other forms of immediacy. Full-motion video is particularly useful if the information you need to convey is about a complex procedure, or has subtleties too hard to describe or see in still pictures. ■

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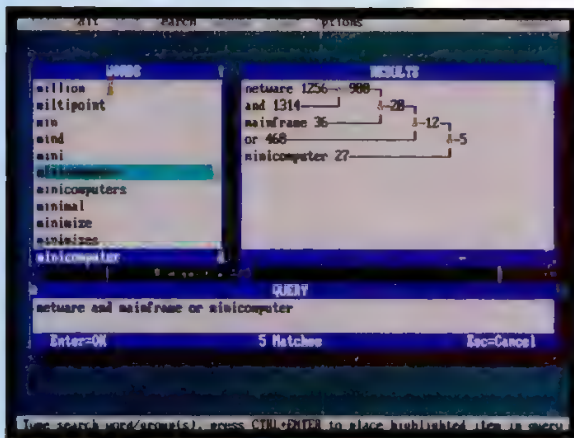


THE PRINTER WITH A PLUS. KODAK

Kodak Ektaplug 7016 printer



SOFTWARE HYPERTEXT



Folio VIEWS lets you search on any word in a document—even “and” and “or.” It provides the fullest indexing of any authoring program and compresses the document and its index to save disk space. Search results are displayed by words and by word combinations.

fobase. Except for these restrictions on graphics linking and the lack of a link to swap text, *Folio VIEWS* offers an excellent variety of link types. Linking is one approach to structure that creates paths through your maze of folios. The grouping method, in which you collect folios associated by topic, hierarchy, or manual selection, lets readers view a subset of the infobase. You can include folios in more than one group at a time.

POWERFUL SEARCH TECHNIQUES

The various structural elements in *Folio VIEWS*—infobases, folios, groups, and links—are designed for fast, easy, accurate information retrieval. The package's first-rate search features allow search strings up to 256 characters—about 42 words. By searching on words like “to” and “or,” you can find very specific expressions, such as “To be or not to be.” Finding this expression would be time-consuming and difficult in a program that doesn't have complete indexing.

You can connect search words in *Folio VIEWS* by using AND, OR, NOT, or the Exclusive OR. By combining these and specifying a group name, you can narrow or expand your searches easily. The results of a search include the number of folios found for every word and combination of words.

In addition to word searching, there are other ways to move through an infobase.

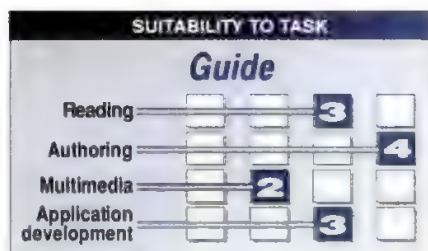
Folio VIEWS provides excellent tools for linking information and grouping ideas.

Guide

OWL International's *Guide*, Version 3.01, is a designer's hypertext authoring program that runs under *Microsoft Windows* 2.x or 3.0 and offers excellent control over document presentation. This \$495 package lets you use multiple fonts, add text or background color, control screen design, and even change the cursor's appearance to identify different types of links. Beneath this graphics surface is hypertext linking that uses menu-driven options to create a variety of links.

Linking is one of the most important authoring tasks. To create a link you simply mark start and end points, which can be anywhere in a frame. You can cut and paste links within a document or between documents and save design and formatting elements as templates for other documents. The program comes with a high-level scripting language so you can create your own interface or partially event-driven applications. The scripting language delivers great flexibility, but its Pascal-like syntax makes it difficult to learn unless you're familiar with programming.

Limitations include the reader program's weak navigational tools and lack



of indexing. You can't attach notes to documents, leave bookmarks, or link directly to digitized sound or animation.

BUILDING A HIERARCHY

Guide displays documents as one long, scrollable text screen or as a collection of frames, similar to chapters in a book. A frame can comprise thousands of words, fit the boundaries of one screen, or isolate graphics for impact.

Whether you choose to compose a document in *Guide* or import an ASCII file, you can insert frames anywhere on a document. These frames provide a useful way to view information in a hierarchical structure, from summary to detailed information.

The linking tool provides another way to create a hierarchy. With Reference buttons (links are called buttons) you can skip around within one document or jump

FACT FILE

Guide, Version 3.01
 OWL International Inc.,
 2800 156th Ave.
 S.E., Bellevue,
 WA 98007; 206-747-3203.
List Price: \$495
 (includes reader coupon, \$49.50); reader runtime version, \$95 per copy; reader runtime licenses start at 100 copies, \$40 per copy.
Requires: 640K RAM (1MB recommended), Microsoft or compatible mouse, *Microsoft Windows* 2.x or 3.0, DOS 3.1 or later.
In Short: *Guide* runs under *Windows* and makes superb use of the formatting and object orientation of the graphics environment. It offers many types of links and has a powerful scripting language, but it's a bit weak on navigation and doesn't automatically index a document.

CIRCLE 401 ON READER SERVICE CARD

to a completely different document. For example, a nested table of contents might contain reference links to deeper layers of information.

The three other types of links include the Expansion button, which reveals hidden text or an illustration while you remain in your current document. The uncovered information can contain other links. The Note button displays a pop-up box of information that remains on-screen while you hold down the mouse button. With the Command button, you can open and close other documents, control your PC's serial port, run a scripted operation, and launch another application. For in-

stance, you could use the Command button to go to a spreadsheet or database and then return to your *Guide* document.

IDENTIFYING LINKS

You can design links so that the word or phrase that initiates a link will cue you to the type of link it is. For example, the default setting makes Reference buttons italic. As you author a document, you can change the button using text attributes. There are other visual clues to link types. When you place your cursor on a link, it changes shape. The default cursor setting for an Expansion button is a telescopic cross-hairs symbol, which you can change to one of three dozen other symbols.

The link variations enable you to search by link type, which adds a dimension to reading or authoring a document. As a reader, you can get a quick sense of what is happening in a document, and as an

author, you can check for the integrity of your links.

You can search for particular text using up to four search strings connected by AND or OR. A search can also use wildcards, be case-sensitive, include hidden material, or target selected documents.

The Navigation menu offers more ways to find information: going frame by frame, backtracking your path, or jumping to the first or last frame in a document. Unfortunately, you can't see a map of links, leave bookmarks, or call up a reading history. With difficulty, you could script some of these abilities into *Guide*.

GRAPHIC CONTROL

As an author, you can take almost total control over the way a document looks, one of *Guide*'s finest advantages. The

program utilizes *Windows* fonts, so you start off with nine—scalable from 8-point to 72-point—and add as many as you like. You can color the text, text background, or document background from a standard palette or customize your own palette by mixing red, green, and blue on sliding scales.

Guide is quite agile when it comes to graphics information. You can place an image anywhere on-screen, adjust its size by stretching or pulling, crop it, and combine it with other images. Graphics can serve as links even without text. In an illustration you can have different types of links and multiple targets, giving you even more flexibility.

The LOGiiX programming language gives you more control than standard menus and commands. LOGiiX lets you further customize the look of documents and add capabilities, such as letting read-

TAKING HYPERMEDIA TO ITS LIMITS

by Henry Ferako-Weiss

Today *multimedia* is a popular industry buzzword that has the same kind of allure desktop publishing had in its early days. Multimedia applications give you stunning presentation possibilities, but they are still rather rare for the same reason desktop publishing took time to catch on: the cost.

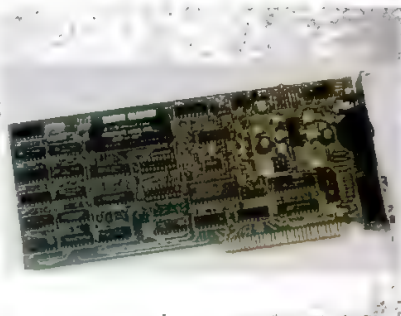
There is a nifty fit between hypertext and multimedia. Using links to turn on a video sequence and then jump back to text is an elegant way to mix information types. For this reason, half of the authoring programs we've evaluated support hypermedia links to video. Two of those four, *HyperWriter* and *Folio VIEWS Professional Edition*, also support digitized sound.

For most hypertext documents, the combination of text, graphics, and photographs is all an author needs to present information, but there are some situations where video and/or sound makes a great deal of sense. For instance, if you're creating a document that will be used to service and repair very complicated and expensive machinery, getting the best information quickly is more important than the cost of delivering the information. There is no faster or better way than full-motion video to convey information about a skill.

If your hypertext documents will benefit from video and sound you need special equipment. The typical source for video information is a laserdisk player. Two popular models, the Pioneer LDP 4200 and the Sony LDV 2000, can each be purchased for about \$1,000. In addition to the player, you'll need a video board for the PC that will overlay the video on the computer's screen. Two popular boards are the DVA 4000 from VideoLogic (\$2,495) and the M-Motion from IBM (\$2,250). New Media Graphics has just introduced a board called Super Video Windows, which sells for \$695.

For the sound part of the system, you'll need a digital audio card to store the sound on your hard disk. Two such cards are the Sound Blaster from Creative Labs (\$249.95) and the MicroKey from Video Associates (\$450). To get high-quality sound you should also have an external speaker, which costs about \$100.

Because sound takes up so much hard disk space—anywhere from 6K to 12K per second's worth of sound—you should have a large hard disk. A 10-minute audio file could eat up over 7MB. Also, running a video and audio board requires about 160K RAM, so you may need to upgrade your memory.



Creative Labs' Sound Blaster card.

All this equipment needs to be on both the author's and the reader's system. If you're installing full video and sound capabilities, the total price tag would be between \$2,000 and \$4,000 for each PC. If you have to distribute a hypermedia document to a lot of people, it can get very costly.

Today, hypertext authoring packages generally approach video and audio links through scripting. In *Guide*, for example, you have to use the LOGiiX programming language to issue commands to the board's driver. This makes linking a bit awkward. However, a new add-on product for *Guide* due out this spring called the Video Tool Kit will let an author look at a video to define and capture sequences and then link to them through a command button. The next version of *Guide* will let an author link to a video sequence directly from *Guide*'s menus. ■

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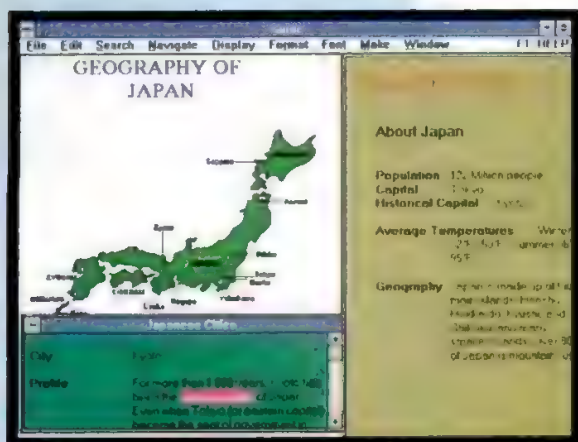
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The Official Computer and Consumer Electronics Convention
at SPIN
Booth 2544 May 30-31, 1991 Atlanta, Georgia

SOFTWARE HYPERTEXT

Guide lets you split the screen so you can see both ends of a link at once. In the map of Japan shown here, the city of Kyoto was clicked on to jump via a reference link to another file with information on various Japanese cities. The window showing "Quick Facts" is a view of related information from yet another file.



ers know the amount of time spent in each part of the document. *Guide's* flexibility in linking and formatting, graphics interface, and scripting language make it an excellent tool for all kinds of hypertext applications, particularly those demanding quality presentation.

Hyperties

Hyperties is the product of a University of Maryland research project known as TIES—The Interactive Encyclopedia System. The \$349 commercial package from Cognetics uses the encyclopedia as its structural and philosophic blueprint. A complete document includes a cover, preface, table of contents, series of articles, illustrations, and an index. *Hyperties'* structure is well suited for applications like training and corporate policy manuals, museum exhibit guides, and reference manuals.

The encyclopedia metaphor makes the transition from bound book to electronic screen less disorienting, and the program's easy-to-use approach succeeds throughout. The essential controls in the Browser, *Hyperties'* reader facility, are reduced to three keys. This simplicity extends to the Author program, which you control with a dozen commands or so.

The simplicity of this single structural metaphor also has disadvantages to keep in mind. There are few layout options, limited editing functions, and no links to other applications. Readers are not able to leave bookmarks or annotate documents, and the search facilities are somewhat modest.

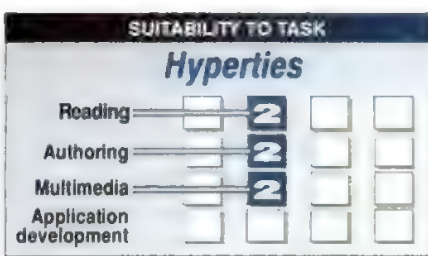
CREATING ARTICLES AND LINKS

There are two ways to create a *Hyperties* document: write articles directly in the program using its editor, or import an ASCII file. In either case, you use a dozen or so mnemonic commands to create links and format an article. The procedure is simple. To set the left margin you use @L; to start a new page you use @N. You can set other

formats including multiple margins, varying line spacing, tables, and indented quotes.

It's easier to use your own word processor to write an article since you can access commands that are missing in the *Hyperties* editor, such as search-and-replace. There is no support for text styling—bold, italic, underline—even on documents that you have imported from your word processor, but you do have control over color.

To identify a *Hyperties* link, you place a tilde on either side of the text you want to link. *Hyperties* does not provide links within any one article, regardless of length. When you make links, you have to "resolve" them before they actually take the reader anywhere. You do this by choosing the article to which the link applies. If you name an article that doesn't yet exist, the link becomes active when the article is present. *Hyperties* linking is semiautomatic and a great time-saver. You define

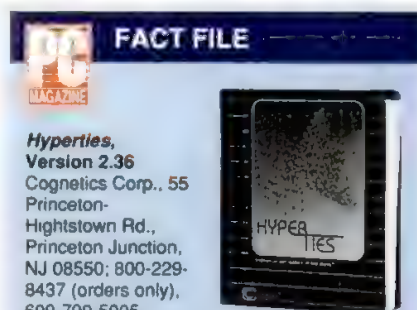


a link once, and the program repeats it without your help throughout the article.

THUMBING THROUGH DOCUMENTS WITH ARROW KEYS

Reading a *Hyperties* document is like reading a printed document, except for the embedded links that jump you from one article to another. Articles in *Hyperties* have three sections: A heading is displayed when you select a link; a description is shown along the bottom of the screen when you choose an article; and the content of the article is displayed if you decide to read the article. Article length is limited to 12K, but you can have as many articles as you like.

You enable the links with the arrow keys, which move the highlight bar from



List Price: with a license for 20 readers, \$349 (larger distribution may cost extra).

Requires: 384K RAM, DOS 2.0 or later.

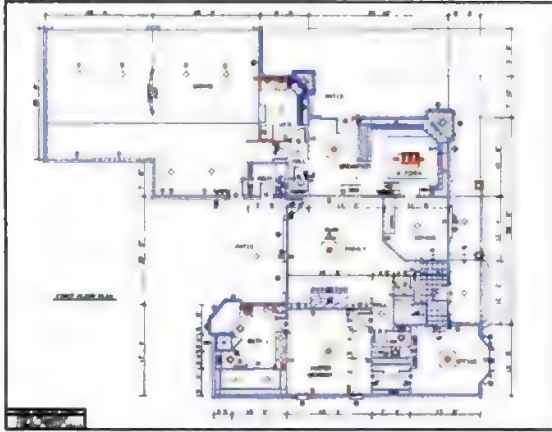
In Short: *Hyperties* documents are structured like encyclopedia articles, containing a series of links, or cross-references, connecting them. Links will jump you to the top of an article, to graphics, to video, or to an application. It's easy to learn and use.

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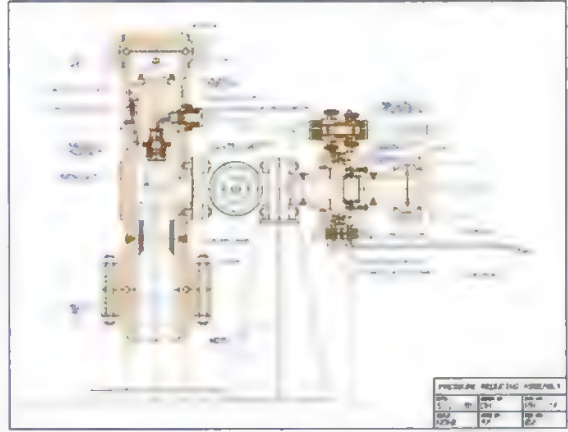
link to link, or you can type the first letter of the colored link words. Press Enter when you're on a link and you get a brief description of the target article. There are several other ways to move through a *Hyperties* document. In the Extra screen, there are file folder tabs labeled Table of Contents, Index, History, and Search. The Table of Contents lists article topics, the Index lists all articles, and the History shows you which articles you've linked. In each case, you can jump to an interesting article by highlighting an entry.

You can look for articles that contain specific words by using the Search function's AND or OR connectors. You can also search for words that follow each other, like George Washington, but you're restricted to just two words. This makes searching fast but limited. The commands listed on-screen are supplemented by hotkeys for quick maneuvering. Hit Ctrl-

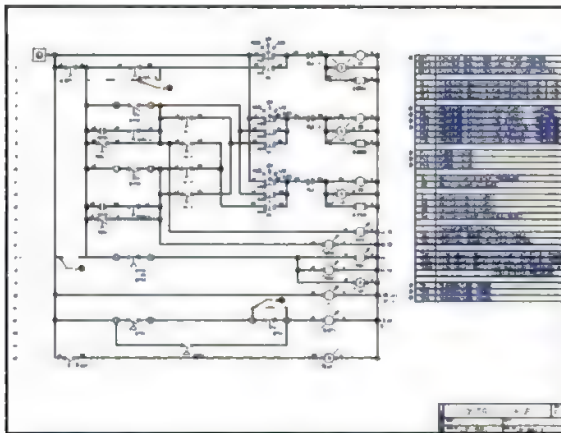
WHAT MAKES A BEST SELLER A BEST SELLER?



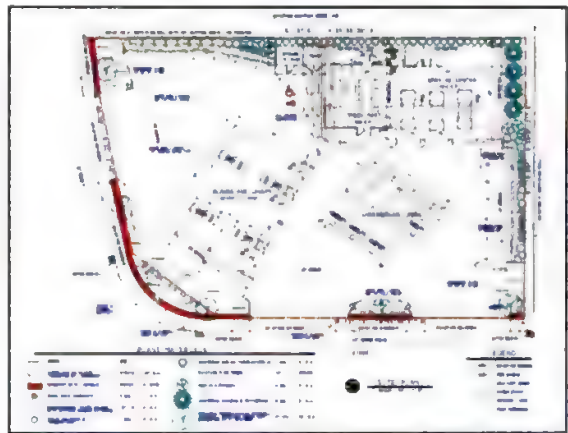
A great plot begins with a great idea, easily translated through every phase of design with Generic CADD 5.0.



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stroke stroke stroke
stroke stroke stroke
stroke stroke stroke
stroke stroke stroke
stroke stroke stroke
stroke stroke stroke

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stroke

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Getting into the programs on your hard disk with DOS commands can take longer than a foursome full of beginners. You should be using Direct Access.

All you do is load it and forget it. Direct Access lines up every program on a menu and lets you create custom sub-menus for related programs and other applications.

It's simple.

And it's complete. With features like user-defined screen blanking, password protection, three-level virus detection, mouse support and a unique feature that automatically tracks all time spent on your programs.

A network version is also available. You can

even customize the menu with your company logo.

The choice is easy. Keep stroking away with DOS commands. Or play through to your programs with Direct Access.

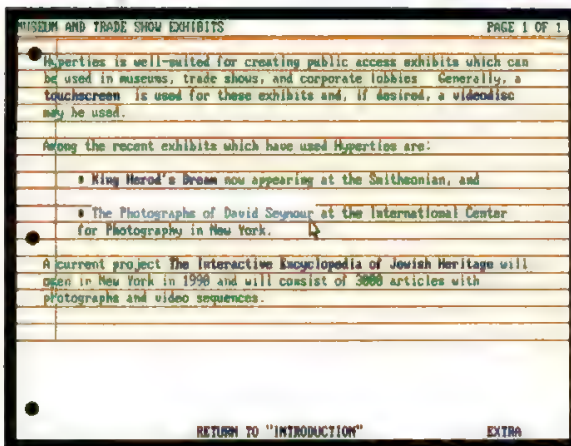
Call now for complete details, volume discounts and your nearest Direct Access dealer. For a limited time, get Pyro!™ The Entertaining Screen Saver for the PC, free! Just write "Pyro" on the Direct Access registration card before you return it.



PC Magazine Editor's Choice

CIRCLE 288 ON READER SERVICE CARD

SOFTWARE HYPERTEXT



In *Hyperties*, links always go to the top of an article or file. Link anchors are shown in a different color, such as the purple used here. Notice the use of a graphics background to give the document more visual interest. This is the only way to color the background.

T and the program takes you to the first article found in the search. Using these search methods, you can quickly and efficiently find the information you want.

Cognetics Corp. has a clearly defined vision of how hypertext software should work. While *Hyperties* is limited to applications using the article metaphor, the package has enough flexibility to create documents with graphics backgrounds, colored text, illustrations, and videodisk sequences. *Hyperties* does the job well, and it's one of the easiest hypertext authoring packages to use and one of the quickest to learn.

Hyper-Word

Hyper-Word, Version 2.02, is a hybrid application combining elements of word processing and hypertext authoring programs. You can write, edit, and format a document the same way you would in a typical word processor, as well as create links within and across files and customize hypertext applications with its scripting language. While limited by text-only links, some awkward editing procedures, and inadequate printed documentation, this \$149 package from Zaron Software lets you create hypertext documents at a bargain price.

With *Hyper-Word*'s simple text-only linking ability, you can create an elec-

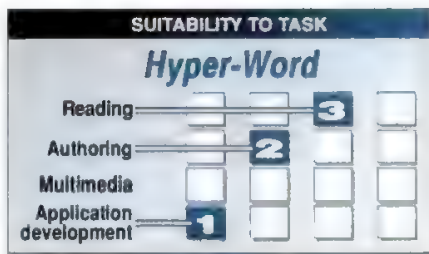
tronic book with a hierarchical structure, build a procedure manual, or use the package as a personal organization tool for tasks such as linking client information to customized letters and phone logs.

DISTRIBUTION READER

To distribute a hypertext document, you can purchase a \$3 standalone reader, Readme, and re-

produce it for free. To use the reader, you follow links by placing the cursor on a highlighted word and pressing the Plus key. To jump back, press the Minus key.

If you follow a series of links in the same file or through a number of files, you can backtrack one link at a time. The Recent Reference List command is the only other technique available to maneuver around documents. Press Alt-Equal sign to get a list of links you've visited. Each listing shows you the filename and



the line of text at the link target, which gives you a good idea of what the link refers to. By selecting any one of these reference points you can jump right to it.

Readme also allows you to find a specified string of text, search for keywords, and print a window. When you start the reader, you can choose one of five color schemes for display.

WORD PROCESSING FEATURES

Hyper-Word's basic word processing features enable you to search and replace text, set margins, number pages, perform block operations, and set page length. You can format text for output using commands for bold, underline, italic, superscript, and subscript. The program uses up to nine windows, which you can open, move, and resize. The few extras in the program let you easily draw boxes, use time and date stamps, record and edit macros, and spell-check documents.

HYPERTEXT SOFTWARE: Defining the Terms

by Henry Fersko-Weiss

authoring: The process of creating a hypertext document.

bookmark: A tag or mark placed in a document so you can jump right back to the spot.

buttons: Icons or boxes used to activate a link. They are the graphical equivalents of highlighted text.

hypermedia: A type of document that combines information in different media, such as text, graphics, video, and sound.

link anchor: The start of a cross-document connection. It's often indicated by text in another color.

link target: The end of a cross-document connection. Link ends are generally not highlighted in any way; they appear as normal text.

scripting language: Similar to a programming language; used to customize the user interface and features of a hypertext document.

swap text or swap link: A link that replaces existing text with new text. A swap link on the cost of a product in yen, for example, would replace that number with the equivalent price in dollars. A swap link can be a number, a word, or a whole section of text.

views: A way of ordering pages or files of a hypertext document to suit an individual reader's needs. Views are generally a subset of the entire document.

The word processing features are complete enough to let you use *Hyper-Word* as nothing more than a word processor, but some functions are cumbersome. For example, after performing a block operation you must go back to the "Block mark" menu to remove the block markers. To reset the margins for an entire document, you have to use the block commands or place a Ctrl-F command in the file, which remains visible on the screen until you hide it.

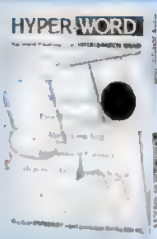
INTELLIGENT LINKS

After you write a file, you can enter hypertext links by following an easy proce-

SOFTWARE HYPERTEXT

FACT FILE

**Hyper-Word,
Version 2.02**
Zaron Software,
13100 Dulaney
Valley Rd., Glen Arm,
MD 21057; 800-669-
3348, 301-592-3334.
List Price: \$149.
Requires: 480K RAM, DOS 2.1 or later.
In Short: *Hyper-Word* is a word processor
with the ability to create hypertext links. Its
word processing abilities are basic and in
some ways awkward to employ, but there is a
scripting language that lets you customize an
application.



CIRCLE 403 ON READER SERVICE CARD

ture. If you put the cursor on a word and press Ctrl-L, a window pops up with the same file in it. You can scroll through it and choose a target, or you can call up another file entirely and link it to any point you wish by moving the cursor and pressing Esc.

Using *Hyper-Word* embedded dot commands, you can instruct the links to perform simple operations when they reach their targets. For example, you could jump to a box in a file and use the .Date command to enter the current date automatically. Dot commands also perform simple math operations, but they require some programming techniques that aren't clearly explained in the on-line help.

These inconveniences are compounded by insufficient printed documentation,

making *Hyper-Word* more difficult to learn than it should be. The package comes with a short pamphlet explaining how to install the program and use the help menu, and there's a Quick Reference Guide card with most of the speed-key commands. Its saving grace is an on-line help system—a hypertext document itself—so you can easily find the information you need, but it's still a cumbersome way to learn the program.

Hyper-Word isn't robust enough for large or complex hypertext authoring applications. You can't link to graphics, other media, or other applications, and the search and navigational tools are weak. *Hyper-Word* offers an inexpensive way to build a small, simple hypertext document, but that's the only rationale for using it in a distributed application.

HyperWriter

While some hypertext authoring programs force information into a fairly rigid structure, offer primitive formatting features, or limit the kinds of links you can make, *HyperWriter* unleashes your imagination. The \$395 package from Ntergaid offers a wide range of link types, superb navigational tools, and an assortment of colors you can apply to every screen element. The supply of formatting options make working with the screen almost like designing on a blank canvas.

HyperWriter's flexibility is the accomplishment of its internal text editor, graphics capture program, and scripting language, which lets you create boxes, add stylistic frames, and create links or action buttons. The package makes efficient use of mouse support, pull-down menus, speed keys, scroll bars, and dialog boxes. Hypertext documents can be one scrollable 200K page or thousands of 25-line

pages. The program's inefficiencies are inadequate documentation, limited searches, and no indexing.

HyperWriter has a large selection of color-coded links based on three main types—text, graphics, and action—and subtypes. For example, the text link lets

SUITABILITY TO TASK				
HyperWriter				
Reading				4
Authoring			3	
Multimedia			3	
Application development			3	

you connect parts of the same page, another page, or a different document. You can also connect to a pop-up comment box, swap text, or go to an ASCII file. An action link connects to DOS programs, a *HyperWriter* menu command, or a script, and there is also support for videodisks and digitized sound.

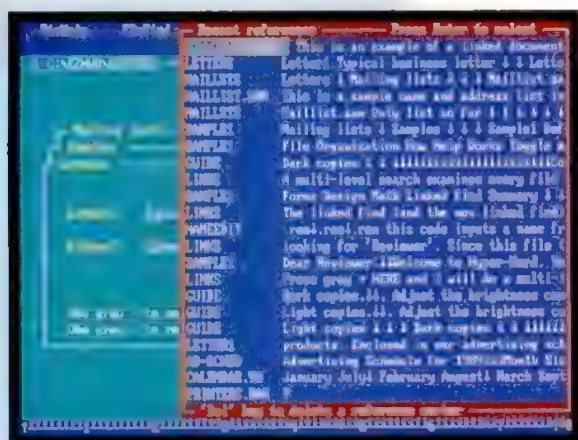
TOP-NOTCH NAVIGATION

HyperWriter unquestionably has the best navigational tools of the products evaluated here, making it easy to find information in a hypertext document. You follow links by clicking with the mouse button or pressing the F1 key. A green link marker indicates a jump to text; blue markers jump to graphics; and a red one connects to an action, perhaps linking you to another application.

You can also design your own buttons from six different shapes and styles that turn the page for the reader, jump to a map, connect the reader to a guided tour of information, or lead the reader to a pop-up note.

The most impressive navigational tool in *HyperWriter* is the graphics map of links, which is similar to a flowchart with the links drawn as boxes containing numbers, a name, or both. The link map screen is divided into three parts: The upper two-thirds of the screen contains a map, the lower left displays a box with a few lines of text for each link as you move through the map, and the lower right displays a map legend.

You can jump directly to the start of a link or a page by highlighting a box on the map. You can also navigate through a document with line markers and page tags, or create paths through a document—called tours—so a reader can look at a history of the last 20 pages viewed, read through a series of notes, or search for a particular string of text. The searches are limited to a single search string with no Boolean connectors, unless you build the document with an index using *Hyper-Indexer*, an add-on product that costs \$149 if purchased with *HyperWriter* and \$195 if purchased separately.



Hyper-Word lets a reader consult a history window which shows every link visited, in reverse order. The link references include the filename and the line of text at the link end to show you the context.

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PC Magazine

Some software companies would have you believe their file management packages do everything but make coffee. But nobody's fooling the pros. With its long list of practical, usable features, XTree has been their favorite for years. InfoWorld says, "This comprehensive DOS shell is packed with advanced features that appeal to power users."

Features like an application menu that lets you launch applications right from XTree. And when you're launching applications it shrinks back to 7K. Like an Open File command that makes starting applications and their associated data files as easy as pointing and shooting. Like split screens, so you can view two directories or drives at once. Like text search. And AutoView, so you can browse through files without starting up the application.

Now, there's an even better reason for managing your files with XTree. It's XTreeGold 2.0, with some important new features that make it better and more useful than ever.

Introducing New XTreeGold 2.0. With Simplified Pull-Down Menus, "Un-Delete", And Autobuild Menu Creation.

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THE HYPERTEXT UNIVERSE

by Henry Fersko-Weiss

APPLICATION GENERATORS

The first program to popularize hypertext and hypermedia techniques was Apple Computer's *HyperCard*. That package lets Macintosh users retrieve and link information using an index-card or stack metaphor. It can be used either to build applications using hypertext links as the glue or for traditional text-to-text linking. There are several *HyperCard*-like packages now available for the PC. In addition, there are other application generators that use a language to do text links, links to actions, and links to other programs.

HYPERCARD-LIKE PACKAGES

- **HyperPad**, Brightbill-Roberts & Co., \$149.95
- **IBM LinkWay**, IBM Corp., \$149 (\$99 to schools)
- **Plus**, Spinnaker Software Corp., \$495
- **ToolBook**, Asymetrix Corp., \$395

DEVELOPMENT LANGUAGE PROGRAMS

- **The Knowledge Engine**, Software Artistry Inc., \$500
- **KnowledgePro**, Knowledge Garden Inc., \$695

PERSONAL INFORMATION MANAGERS

The most common form of hypertext link is the reference link, which jumps a user between two related pieces of information. Some personal information managers (PIMs) have adopted this type of link to let users connect calendar items with phone book items or to tie together two outline files. Some PIMs also use a comment link, which connects an appointment or address entry to a pop-up note.

- **GrandView**, Symantec Corp., \$295
- **Memory Mate**, Broderbund Software, \$69.95
- **PackRat**, Polaris Software, \$395

HELP SYSTEMS

Hypertext is ideal for help systems. Typically, when you use help, you want to go from broad topics to details and jump around to see related information. This type of browsing is made much simpler with hypertext links.

Hypertext help systems come in two varieties: as part of the internal functions of a program and as standalone utilities.

INTERNAL

- **Microsoft Windows 3.0**
- **Novell's NetWare** (built with *Folio VIEWS* and using a runtime version of that product)

STANDALONE

- **DOS Help!**, Flambeaux Software (makers of *xText*), \$49.95
- **Tech Help!**, a reference for system-level programmers, Flambeaux Software, \$124.95

The technique of hypertext linking can be applied in many different ways to a broad range of applications. Some of the very early uses of hypertext were in help systems and personal information managers, and the technique has also crept into text retrieval software, application generators, and expert systems. The most extensive use of hypertext is in the authoring programs we review here. The lists on this page show where hypertext is currently being applied. Its use is certain to spread, because the ability to jump a user from one place to another in a program has a place in nearly every type of software.

AUTHORING PROGRAMS

These packages use hypertext and hypermedia techniques to the fullest. They offer a variety of text link types, as well as links to graphics, photographs, video, sound, and animation. They are used to build manuals, training courses, museum exhibits, and the like. This evaluation takes an in-depth look at eight of these packages.

EXPERT SYSTEMS

Expert systems are tools for using an embedded base of expert knowledge to help users diagnose problems, troubleshoot operations, or plan a course of action. Hypertext is used in these systems to jump users to clarifying information and to explore the rules of knowledge that are being applied to a particular case.

- **1st-Class HT**, 1st-Class Expert Systems, \$2,495
- **Guru**, MBDS Inc., \$6,500
- **Personal Consultant Plus**, Texas Instruments, \$2,950

SOFTWARE HYPERTEXT

ALMOST GRAPHICAL

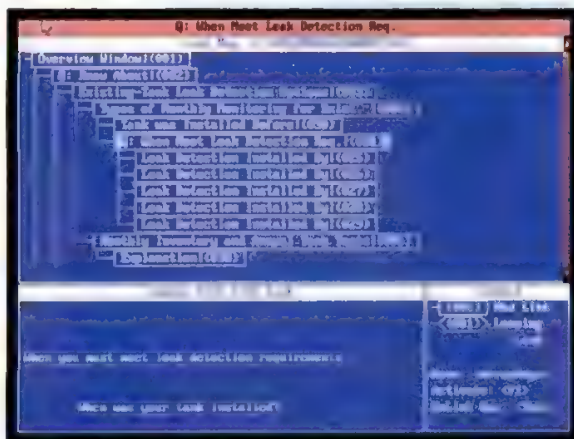
HyperWriter's ability to integrate large lettering and logos as .PCX files gives the program the look and feel of a graphical user interface, without the ability to resize or rotate graphics. By writing scripts to add buttons, accent lines, and colors, you can control the screen's appearance, although the documentation does not clearly explain how to write these scripts.

Whether you write a document in *HyperWriter* or import a file, you can format the screen quite easily with block commands to justify text or set right and left margins, tabs, indents, and page breaks. There's even a spell-checker. Text formatting includes bold, italic, underline, and double underline, which are visible only when a document is printed. Text colors are visible on-screen.

While *HyperWriter's* scope of features is impressive, one shortcoming is the documentation, which provides insufficient screen images and explanations of features. The package comes with two manuals, but information is presented ineffectively. For this reason, *HyperWriter* is more difficult to learn than it should be (though improved documentation is expected). The package offers only limited search capability and provides no indexing features, except through the *HyperIndex* add-on.

The package offers features that are too extensive to cover in a short evaluation,

***HyperWriter* has extensive navigational tools for a reader. One of them, shown here, is a graphics representation of a document's links. Each link can be named and numbered, and by pointing at any of these links you can jump right to it.**



ation, but the list includes macros, word links that function for every instance of a specified word, group authoring ability with password protection, and encryption. Providing all these features plus styling tools for stunning, colorful designs, *HyperWriter* is a dynamic program for almost any hypertext application. This is a must-see product for anyone considering a hypertext authoring program.

SmarText

SmarText takes full advantage of the *Microsoft Windows* graphical environment with a stunning array of icons and offers strong indexing abilities with varied linking options and viewing conveniences. In addition to all of its techniques for graphical control, the package incorporates artificial intelligence techniques that can automatically generate links, outlines, and indexes.

Document editing and formatting are disappointments, however, since the package lacks both an editing function and a scripting language. These omissions force you to work with an external word processor, an unexpected weakness in this \$495 *Windows* application from Lotus Development Corp. (*SmarText* was formerly a Samna product). The reader module is an additional \$99.

ICONS GALORE

SmarText shows off its unique design from the start by displaying a dozen icons down the left side of the screen. As the visual equivalent of speed keys, icons let you bypass menus. The default setting lets you conduct a Boolean search, insert notes, cycle to the next illustration, view the outline, leave a bookmark, and tile windows (view several nonoverlapping windows on-screen at once).

You can select icons from a list of 37 or choose to hide them. This gallery of icons lets you backtrack through your reading path, create or break links, promote or demote outline items, and open and close documents. You can invoke most of the icon functions from keyboard function keys or use Alt-Ctrl-key combinations, but the icons are quickly learned and make *SmarText* easy and fun to use.

Other design elements make it easy to read documents. Select the summary window for a brief document description, or tile windows to view all at once a subject or chapter outline, the index, and the text itself. You can efficiently maneuver around documents by opening these three document views. To jump right to a topic, highlight it in the outline window. In the index window you can see every occurrence of a word in the context of a line and jump directly to the right spot. The outline contains a list of graphics so you can quickly find just the one you want. Or you can bypass a picture easily, since text and graphics links are color-coded.

The bookmark is another convenient reading tool that you create, name, and use as a trail through the document. You can create as many bookmarks as you want to mark points for quick reference.

Searching and creating views are two other notable reading elements. *SmarText* lets you hunt for three search strings at once using AND, OR, or AND NOT as

SUITABILITY TO TASK				
SmarText				
Reading	☐	☐	☒	☐
Authoring	☐	☐	☒	☐
Multimedia	☐	☐	☐	☐
Application development	☐	☐	☐	☐

connectors. You can also ask the program to search for words in a certain order and specify the number of characters that separate them. Views offer alternative



FACT FILE

EDITORS' CHOICE

HyperWriter,

Version 2.53

Niergaud Inc., 2490
Black Rock Tpke.,
#337, Fairfield, CT
06430; 203-368-
0632.

List Price: \$395.

Requires: 384K
RAM, DOS 3.0 or later.

In Short: *HyperWriter* can be used to build long, scrollable documents or tightly structured page-oriented systems. You can create almost any kind of link, except to animation. It has terrific navigational tools for readers and fine editing and formatting tools for authors.

HyperWriter!

CIRCLE 464 ON READER SERVICE CARD

FACT FILE

SmarText,

Version 1.0

Lotus Development Corp., 5600 Glenridge Dr., Atlanta, GA 30342; 800-831-9679, 404-851-0007.

List Price: \$495; reader module \$99.

Requires: 640K RAM, mouse, Microsoft Windows 2.x or 3.0, DOS 3.0 or later.

In Short: Like *Guide*, *SmarText* is a Windows application, but it's more limited in the variety of its link types, its use of fonts, and its ability to manipulate graphics and use color. Its strengths: the use of icons for many functions and the ability to create links and index an imported file to the degree specified by the author.

CIRCLE 405 ON READER SERVICE CARD



ways of arranging the material in your original document. They may be subsets of information or different organizational perspectives. Each view has its own outline and index. Although readers can't create their own views, they can select from views created by the author.

AUTOMATING HYPERTEXT

SmarText's ability to automate hypertext links is innovative but not without drawbacks. After you import a file—which is the only way you can create a document—you go through a build procedure in which you indicate the degree of linking you want within a minimum-to-maximum range. *SmarText* then analyzes your document and, according to the linking degree you've specified, automatically links single occurrences of words or phrases to the same words or phrases where they occur more frequently in other sections.

This may save you a great deal of time in creating links, but it may also give you lots of links you don't want. You must manually enter all links to graphics, other applications, or topics that are related but don't use the exact word or phrase. *SmarText* automatically creates a document's index and outline. As with linking, you can control the extent of the indexing on a minimum-to-maximum scale using what is called an elevator button.

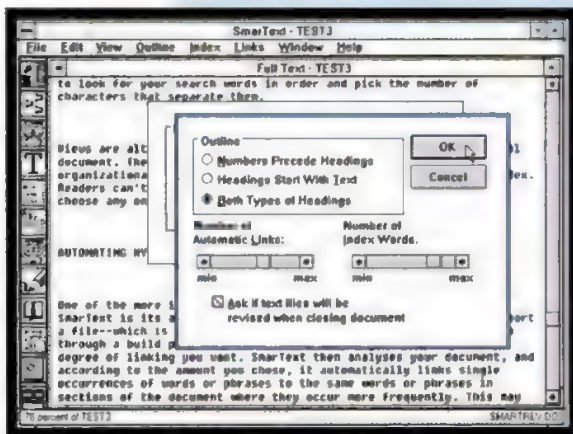
DARING YET DISAPPOINTING

Despite its daring attempt at automation, *SmarText*'s authoring program has some fundamental weaknesses, particularly its cumbersome approach to editing. You can't alter the text of your document once it's imported; this forces you to plan your document carefully before you import it or to face the tedious task of going back and forth through *Windows* to your word processor.

SmarText offers little control over document formatting. You can import some native file formats, but the program ignores almost all formatting. You can't use multiple fonts for text, change justification, alter line spacing, control margins, apply color to text (unless it's a link), or apply background color.

The inability to link directly to video-disk sequences, digitized sound, or animation are other authoring limitations.

SmarText is the only authoring program that can create automatic links in an imported document. You have control over the extent of the linking by moving a button between "min" and "max."



And without macros or a scripting language, you can't customize functions or build new applications. Printing control is also limited.

SmarText has a graphical user interface and automatic linking that push the state of the art forward. Unfortunately, the package steps backward at the same time by neglecting basic editing and formatting capabilities.

TransText

TransText, Version 90, is a full-fledged word processor designed primarily as a writing tool with the ability to create hypertext links. A product of MaxThink, the program is also the core of a patchwork of programs that, when stitched together, form a hypertext authoring program. The approach is cumbersome, but for \$89 it's a good place to start and build a hypertext network application constructed with other hypertext tools from MaxThink.

You can build
hypertext documents
directly in *TransText*'s
own word
processor.



The program's limitations start with an inflexible structure. You embed links in a document by placing angle brackets on either side of a filename. While you can change the linking symbol, that's the extent of your design freedom. Links to graphics are possible, but you can't manipulate images within the program, and you can't create links to other applications or to other media.

A CHOICE OF TWO READERS

The *TransText* runtime reading program comes in two forms: *HyperRez* and *Hyplus*. *HyperRez*, the simpler of the two, handles files up to 20K and nested links up to 32 levels. You can link only to Color-TX graphics files, which are created by just a few programs, including an \$89 character-based paint program from MaxThink called *Color-TX*. The navigation functions in *HyperRez* are limited to following links one at a time forward or backward, or jumping to the file where you started following links. These limitations are the downside of this memory-resident program, which takes up only 60K of RAM.

Although limited, *HyperRez* has two notable functions that allow you to build a hypertext help utility for any application. With *HyperRez* loaded in memory, you

The body of The heart and



a laptop. soul of a PS/2.

INTRODUCING A PS/2 LAPTOP THAT'S FULL OF FEATURES. NOT COMPROMISES.

Making a computer light enough to take anywhere and small enough to sit on a lap isn't enough. Making it perform like one that sits on a desk is the true challenge. That's why IBM has created a computer that delivers true portability without sacrificing true performance—the Personal System/2[®] Laptop 40 SX. At just 7.7 pounds it's clearly a lightweight computer. But it certainly doesn't act like one.

DESKTOP PERFORMANCE, WITHOUT THE DESK.



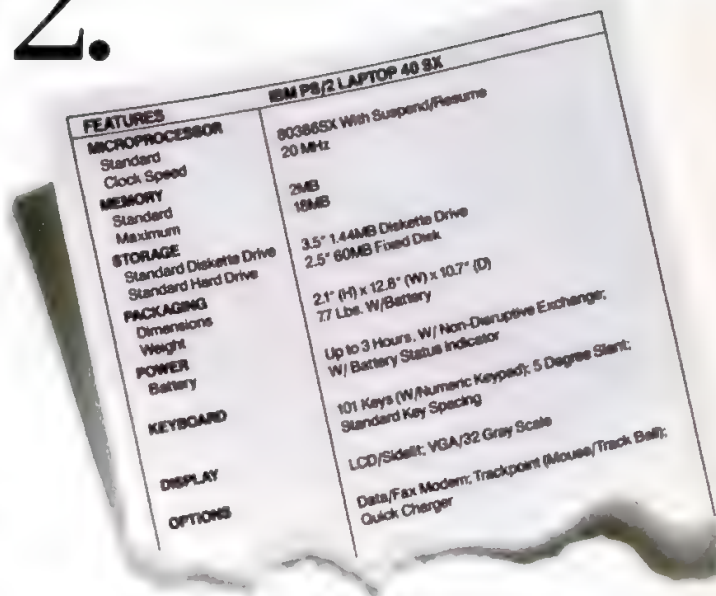
The PS/2[®] Laptop looks great from the outside. But its true beauty lies inside, where you'll find uncompromised computing power. It has the same 386SX[™] 720 MHz processor found in best-selling desktop models. A 3.5" 1.44MB

disk drive provide fast access to programs and data, and standard 2MB RAM is expandable to 18MB.

Instead of compromising comfort by altering the keyboard, the PS/2 Laptop has a full-size keyboard spaced and arranged the same way as a desktop PS/2's. And instead of squeezing information onto a pint-size screen, it has a sidelit LCD that offers a 10²-diagonal viewing area. It delivers sharp, clear text and graphics with VGA quality in 32 shades of gray. With so much to offer, the PS/2 Laptop succeeds at being small, without being small-minded.

THE PS/2 LAPTOP IS ONE LAPTOP NOT TO BE TAKEN LIGHTLY.

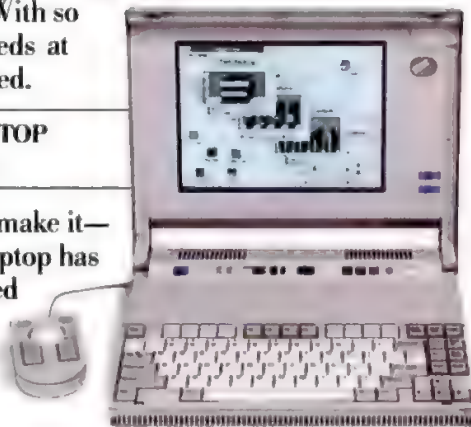
IBM knows it's not how small you make it—it's how you make it small. The PS/2 Laptop has system status icons that monitor assorted functions and battery life. Extensive power management controls include the ability to change batteries in the



middle of an application without exiting and a special feature that suspends power when the screen is closed, then returns to full power when reopened, resuming applications where they were left off without the need to save to the hard drive.

Of course, it comes with an AC adapter, and a 2400 BPS Data Modem/9600 BPS Fax Modem is available, as well as a special mouse that doubles as a trackball when turned over. And the PS/2 Laptop comes with something no laptop should be without—an international warranty* backed by thousands of Authorized Remarketers worldwide, so service and support are never far away.

To find out more, contact your IBM Authorized Remarketer or IBM marketing representative. You'll see why with the new PS/2 Laptop, you don't need a whole lot of room to get a whole lot of computer.



How're you
going to do it?
PS/2 it!

IBM[®]

*Available only in the countries in which this product is sold by IBM and IBM Authorized Remarketers. Subject to the terms of the limited warranty provided when purchased. Proof of original purchase may be required. IBM, Personal System/2 and PS/2 are registered trademarks of International Business Machines Corporation. 386SX is a trademark of Intel Corp. ©1991 IBM Corp.



HYPertext PROGRAMS: SUMMARY OF FEATURES

Products listed in ascending price order

	TransText	xText	Hyper-Word	Hyperties	HyperWriter	Guide	SmarText	Folio VIEWS Professional Edition
List price	\$89.00	\$139.95	\$149.00	\$349.00	\$395.00	\$495.00	\$495.00	\$695.00
PROGRAM DESIGN								
Uses expanded memory	☐	☐	☐	☐	☒	☒	☒	☒
Amount of disk space used by default installation	400K	500K	1.1MB	1.5MB	2.4MB	2.5MB	2.5MB	1.5MB
Uses speed keys	☒	☒	☒	☒	☒	☒	☒	☒
Supports mouse	☐	☒	☒	☒	☒	☒	☒	☒
Maximum file size	300K	18MB	64K	48K	200K	1MB	32MB	2GB
Maximum number of files in memory	6	1	10	500	Unlimited	32	500	1,000
READING								
Table of contents	☐	☐	☐	☒	☐	☒	☒	☒
Index	☐	☐	☐	☒	☐	☒	☒	☒
Lists graphic images	☐	N/A*	☐	☐	☐	☐	☒	☐
Reads programs loaded independently	☐	☒	☐	☒	☒	☐	☒	☐
Shows page or frame number	☒	☐	☐	☒	☐	☐	☐	☒
Shows total number of pages	☒	☐	☐	☒	☐	☐	☐	☒
Shows links in different colors	☐	☒	☒	☒	☒	☒	☒	☒
Shows links in different type style	☐	☐	☐	☐	☐	☒	☒	☐
Shows links by markers	☒	☐	☐	☐	☒	☒	☐	☒
Can print from reader	☒	☒	☒	☒	☒	☒	☒	☒
Can use scroll bar	☐	☐	☒	☐	☒	☒	☒	☒
Can split screen	☐	☒	☒	☐	☐	☒	☒	☒
NAVIGATION								
Can retrace links one by one	☒	☒	☒	☒	☒	☒	☒	☒
Can jump back to start of original link	☐	☐	☒	☒	☒	☒	☐	☒
Can jump back to a tagged page	☒	☐	☒	☐	☒	☒	☒	☒
Has graphics map of links	☐	☐	☐	☐	☒	☐	☐	☐
Has bookmarks	☒	☐	☐	☐	☒	☐	☒	☒
Uses Goto command	☐	☐	☐	☐	☒	☒	☐	☒
Shows reading history	☒	☐	☒	☒	☒	☐	☐	☐
Reader can attach notes	☒	☐	☒	☐	☒	☒	☒	☐
SEARCHING								
Searches by AND, OR, and NOT	☐ / ☐ / ☐	☐ / ☐ / ☐	☐ / ☒ / ☐	☒ / ☒ / ☒	☒ / ☒ / ☒	☒ / ☒ / ☒	☒ / ☒ / ☒	☒ / ☒ / ☒
Searches by proximity	☐	☐	☐	☒	☒	☐	☒	☒
Searches across files	☐	☐	☐	☒	☒	☒	☒	☒
Number of simultaneous search strings	128	None	80	2	30	4	3	256
Can define where to search	☐	☐	☒	☐	☐	☒	☐	☒
Displays results per search string	☒	☐	☒	☒	☐	☐	☒	☒
Displays results by search combination	☐	☐	☒	☒	☒	☒	☒	☒
Results show search string in context	☒	☐	☒	☐	☐	☐	☒	☒
AUTHORING								
Works with text frames	☒	☒	☒	☐	☒	☒	☐	☒
Displays status line	☒	☐	☒	☒	☒	☐	☒	☐
Creates pop-up comments	☐	☐	☒	☒	☒	☒	☒	☒
Creates views	☒	☒	☒	☒	☒	☒	☒	☒
Uses coding	☐	☒	☐	☒	☐	☒	☐	☒
Uses freeze mode	☒	☐	☐	☐	☐	☒	☐	☒
Uses macros	☒	☐	☒	☐	☒	☐	☐	☐
Uses scripting language	☐	☐	☒	☐	☒	☒	☐	☒
Can color document background	☒	☒	☒	☒	☒	☒	☒	☒
Can save structure elements	☒	N/A*	☒	☐	☒	☒	☐	☒

☒—Editors' Choice ☒—Yes ☐—No

N/A*—Not applicable: The product does not have graphics capability.

N/A*—Not applicable: The product is word processor dependent.

CONTINUES

SOFTWARE HYPERTEXT



HYPERTEXT PROGRAMS: SUMMARY OF FEATURES

Products listed in ascending price order

	TransText	xText	Hyper-Word	Hyperties	HyperWriter	Guide	SmartText	Folio VIEWS Professional Edition
LINKING								
Link types:								
Text in current file	☒	☒	☒	☐	☒	☒	☒	☒
Text in another file	☒	☐	☒	☒	☒	☒	☒	☒
Swap text	☐	☐	☐	☐	☒	☒	☐	☐
Graphics	☒	☐	☐	☒	☒	☒	☒	☒
Scanned photos	☒ (.PCX only)	☐	☐	☒	☒	☒	☒	☒
Other applications	☐	☐	☐	☒	☒	☒	☒	☒
Video disk	☐	☐	☐	☒	☒	☒	☐	☐
Digitized sound	☐	☐	☐	☐	☒	☐	☐	☒
Animation	☐	☐	☐	☐	☐	☐	☐	☒
Automatic linking	☐	☐	☐	☐	☐	☐	☒	☒
Assisted linking	☐	☐	☒	☒	☒	☐	☒	☒
Can control link display	☒	☒	☒	☒	☒	☒	☒	☒
Can name or number links	☒	☒	☐	☐	☒	☒	☐	☒
Can link from illustration zone	☒	☐	☐	☐	☒	☒	☒	☐
Can unlink with one command	☐	N/A*	☒	☒	☒	☒	☒	☒
INDEXING								
Indexes by all words	☐	☐	☐	☐	☒	☐	☐	☒
Indexes by key words	☒	☐	☐	☐	☐	☐	☒	☐
Indexes by words to ignore	☒	☐	☐	☐	☒	☐	☒	☐
Can control extent of index	☐	☐	☐	☐	☐	☐	☒	☐
Can add and delete index words	☒	☐	☐	☒	☐	☐	☒	☒
Has multiple indexes	☐	☐	☐	☐	☒	☐	☒	☒
EDITING								
Justification	☒	N/A*	☒	☒	☒	☐	☐	☒
Tab	☒	N/A*	☒	☒	☒	☒	☐	☒
Margin control	☒	N/A*	☒	☒	☒	☒	☐	☐
Page breaks	☒	N/A*	☒	☒	☒	☒	☐	☐
Cut and paste	☒	N/A*	☒	☐	☒	☒	☒	☒
Block operations	☒	N/A*	☒	☐	☒	☒	☐	☒
Search and replace	☒	N/A*	☒	☐	☒	☒	☒	☐
Undo	☐	N/A*	☒	☐	☐	☒	☒	☐
Text attributes:								
Bold	☒	N/A*	☒	☐	☒	☒	☒	☒
Italic	☒	N/A*	☒	☐	☒	☒	☒	☐
Underline	☒	N/A*	☒	☐	☒	☒	☒	☒
Double underline	☐	N/A*	☐	☐	☒	☐	☐	☐
Color text	☐	N/A*	☒	☒	☒	☒	☒	☒
Color background	☐	N/A*	☐	☒	☒	☒	☒	☒
Number of fonts	1	N/A*	None	1	1	9	3	1
Number of point sizes	1	N/A*	4	1	1	11	1	1
Spell checker	☐	N/A*	☒	☐	☒	☐	☐	☐
GRAPHICS FEATURES								
Includes screen capture utility	☐	N/A*	N/A*	☐	☒	☐	☒	☐
Can cut and paste images	☐	N/A*	N/A*	☐	☒	☒	☐	☐
Can adjust image size	☐	N/A*	N/A*	☐	☐	☒	☒	☒
Can restore to original size	☐	N/A*	N/A*	☐	☐	☒	☒	☐
Can mix text and graphics	☐	N/A*	N/A*	☐	☒	☒	☒	☒
Can combine graphics	☐	N/A*	N/A*	☐	☐	☒	☐	☐
Can support 256-color VGA	☒	N/A*	N/A*	☒	☒	☒	☒	☒
Can support 800-by-600 resolution	☒	N/A*	N/A*	☐	☐	☒	☒	☒
Can support 1,024-by-768 resolution	☒	N/A*	N/A*	☐	☐	☒	☒	☒
Maximum size of graphics file	100K	N/A*	N/A*	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited

☒—Editors' Choice ☒—Yes ☐—No

N/A*—Not applicable: The product does not have graphics capability.

N/A*—Not applicable: The product is word processor dependent.

CONTINUES

The ultimate notebook PC and its place in your life.

You've just finished The Big Meeting and you head out of the building, a dozen ideas filling your mind. Budgets, forecasts, letters and directives to members of your team all appear on your mental list of things to do. You hop a cab for the airport, wishing you could get your hands on a PC. Unfortunately, yours is holding down a corner of your desk back at the office.

Wish no more.

Next trip you can tuck away all the computer power you need in the bottom section of your briefcase. Right now, take a few minutes to imagine how it's going to be when you're out there with that list of tasks, several sheets full of notes and your Texas Instruments TravelMate™ 2000 in hand.

The first thing you like about the TM 2000 is its scant 4.4 lbs. — a six pack of soft drinks weighs a lot more. With many of the common notebook computers tipping the scales at around 7 lbs., you might think we left something out. Not much. Your bantam-weight includes a built-in 20MB hard drive, 286™ processor, 10" diagonal VGA screen, AT®-style keyboard, up to two-hour rechargeable battery and standard 1MB RAM. Yes, all that.

At 8.5" x 11", your TM 2000 could almost be lost under a sheet of letterhead. Most three-ring binders are thicker than its 1.4", so you might wonder why it's called a "notebook."

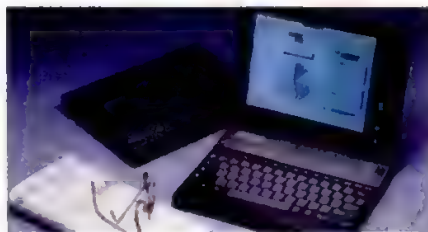
You switch on your new TM 2000 to see what you can do with 286 power. You find it already supplied with an array of free extra-value software — standard, not optional: MS-DOS® 4.01, Battery Watch®, LapLink™, Laptop File Manager and a set of special utilities that do things like extend battery charge life and customize the TM 2000 display. What's more, your TM 2000 swallows up huge chunks of software quicker than you can say "twelve megahertz clock speed."

Once on board, you'll like how fast your programs run. They seem to go quicker than your fingers on the keys, and easily as fast as a desk-bound 286. As for take-it-with-you capacity, you have all you need with the 20MB hard disk drive.

Small outside, enormous inside.

You can boot up popular software with room to spare on 1MB RAM, or take on the latest colossus with optional expansion up to 3MB RAM.

Small, yes, but this is no scaled-down compact, robbed of the features you're used to in the office. Take the keyboard, for example. You recognize its AT-enhanced configuration with a full 79-key inventory of the alpha-numerics you know and need. What the skeptics don't



The Texas Instruments TravelMate™ 2000.
4.4 lbs., 286 CPU, 12MHz.

expect, however, is the full size and solid feel of the keys. They're all arranged in less than 11 inches, side to side. Put a ruler to the AT keyboard in your office and you'll wonder how it's possible!

Well, here's part of the secret. You can get an optional outboard numeric keypad. You plug it in when you do heavy number crunching. The rest of the time you don't need it, so it's not there just taking up space. Makes sense.

Easy on the eyes.

As for the display, you're looking at serious high-resolution technology: a 640 x 480 VGA 10" diagonal, sidelit, reversible black-on-white, picture-perfect, triple-supertwist LCD screen that makes complex graphics and windowing applications show up like ink on paper. With 16 gray scales, visibility is magnificent under just about any lighting condition. Check it out!

Major league interface.

The TM 2000 wasn't built to be a minor player, so it can support all the interface capability you need. Its serial (RS-232C) nine-pin interface is standard. There's also a parallel (Centronics) port for your printer. You can drive your VGA color monitor with a CRT interface option. Or you can plug in an optional 2400 bps modem with send/fax capability. An optional multislots expansion station for one full- and one half-size IBM PC/XT/AT®-compatible cards rounds out your flexible interface array.

That's not to say you won't have to sacrifice.

To keep you light on your feet, something had to give. So we took the 3.5" floppy disk drive out and made it optional. Now you only carry it with you when you need it. Besides, you can transfer files between your TM 2000 and a desktop PC fast and easy with LapLink.

Awards winner.

When you add it all up, you'll understand why BYTE magazine said, "The TravelMate is as close as you can get to the ultimate portable."* In fact, BYTE gave the TM 2000 its 1990 Award of Excellence, acclaiming its exceptional value for the money and smart design. Not only that, PC World named it their 1990 Best

Buy for its premium power and portability. And PC Magazine was so impressed that its editors gave the TM 2000 their most prestigious awards: the Editor's Choice Award — for two consecutive years — and the 1990 Award for Technical Excellence.

Yes, awards are great. But what we really aim to win is your vote. So we built this new look of power to be one you can count on. After all, Texas Instruments has more than two decades of experience in portable computing under its belt. That's why we're able to support the TM 2000 with a worldwide network of authorized service representatives.

Turn your "things-to-do" into "all done."

Now, about those budgets, forecasts, letters and directives. No problem. You finished them all before your plane touched the ground.

Seeing is believing!

Dial our toll-free number. We'll tell you where you can see the TravelMate 2000 for yourself. And see how light, thin and powerful it really is. Then see yourself finding a place for this ultimate notebook PC in your life. It'll cost less than you think!

Call today! You'll receive a brochure that's a life-size replica of the TM 2000 along with the name of a dealer near you. Don't wait!

A lot more speed and power. Just a little more weight.

The Texas Instruments TravelMate™ 3000. Only 5.7 lbs. including 20 MHz 386™ SX CPU, 20-30-40-60MB hard disk, built-in 3.5" floppy drive and internal rechargeable battery that works up to three hours. It's a mere 1.3 lbs. more than the TM 2000, but magnitudes beyond in capacity. Compare them here or at your dealer.



The Texas Instruments TravelMate™ 3000.
8½" x 11" and only 1.8" thin.

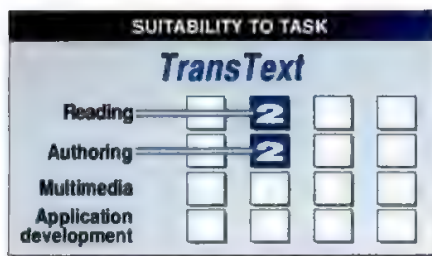
Size up these heavy-duty lightweights for yourself

	TM 2000	TM 3000
Size:	4.4 pounds, 11" x 8.5" x 1.4"	5.7 pounds, 11" x 8.5" x 1.8"
Performance:	12 MHz 286 processor, 1MB RAM (expandable to 3MB)	20 MHz 386SX processor, 2MB RAM (expandable to 6MB)
Display:	Reversible 10" black-on-white sidelit LCD with 640 x 480 VGA resolution in 16 shades of gray	Reversible 10" black-on-white sidelit LCD with 640 x 480 VGA resolution in 32 shades of gray
Storage:	20MB hard drive, optional external 1.44MB 3.5" floppy drive module	20-30-40-60MB hard drive, internal 1.44MB 3.5" floppy drive

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**TEXAS
INSTRUMENTS**



can embed a hypertext link on the screen of your spreadsheet program, for instance. Then you can call up *HyperRez* and use the on-screen link to activate the help system that you have designed for your spreadsheet program. *HyperRez* can also go out to a network file server so that a number of people can use it interactively across a LAN.

Hyplus is a significantly more capable reading program that works with files of any size (limited only by disk space) and

You can build your hypertext system in the *TransText* word processing program or import existing files.



links to and from .PCX and Color-TX files. The program is not memory-resident and does not work on a LAN, but it includes more complete navigational tools that allow readers to leave bookmarks in a hypertext document or call up their own word processor to edit a document or record comments. Also, readers can view a list of links they've followed and jump directly to any one. *Hynet*, a \$489 enhanced version of *Hyplus* that runs on a LAN, is intended for workgroup applications where hypertext systems are created and used collaboratively by several people on a network.

NO-FRILLS AUTHORING

You can build your hypertext system directly in the *TransText* word processing program or import existing ASCII or *WordStar* files. Word processing functions allow you to justify text, use tabs,

SOFTWARE HYPERTEXT

and set margins and page breaks through pull-down menus. You can also modify text for output using bold, underline, and doublestrike.

The program can record and edit macros, perform block operations, open and size up to six windows, and do just about anything else that a basic word processor should be able to do. The one noticeable

missing piece here is a spell-checker, but the program will work with Borland's *Turbo Lightning*.

If you import a file, you can use various utilities that come with *TransText* to make them more amenable to hypertext applications. For example, a program called FS will split a large file into small, manageable pieces, and MP builds hypertext links to defined phrases.

Creating hypertext systems with *Trans-*

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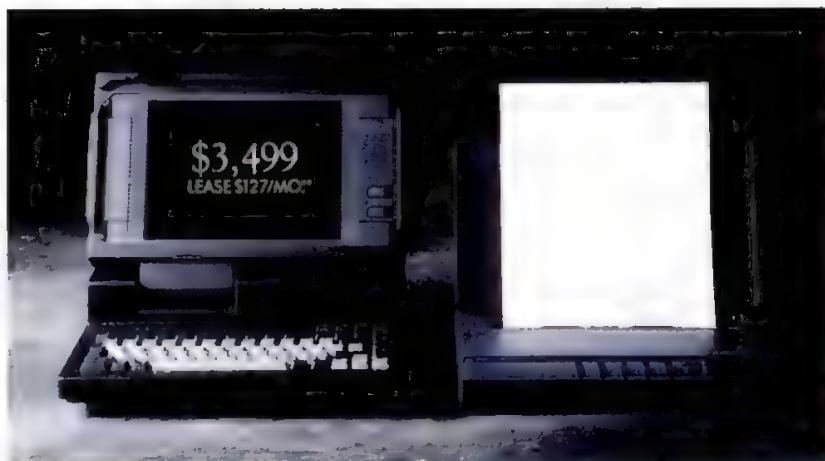
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OKAY.**



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The Dell 320LT, even without any freebies, is an exceptional value. It has received PC Magazine's Editors' Choice award. And at just \$3,499, it's now priced far less than many of our competitor's laptops.



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So hurry and order your Dell laptop. Because this offer is only valid through 6/30/91. And don't forget to ask for that free extra.



WOW!

It's almost painful what Compaq expects you to pay for a computer these days, particularly when the days of unlimited budgets are long gone.

And while Compaq makes fine systems, Dell has comparably-configured systems for a lot less than Compaq's published prices.

Like the ISA-based Dell® 325D and Dell 333D 386™ systems.

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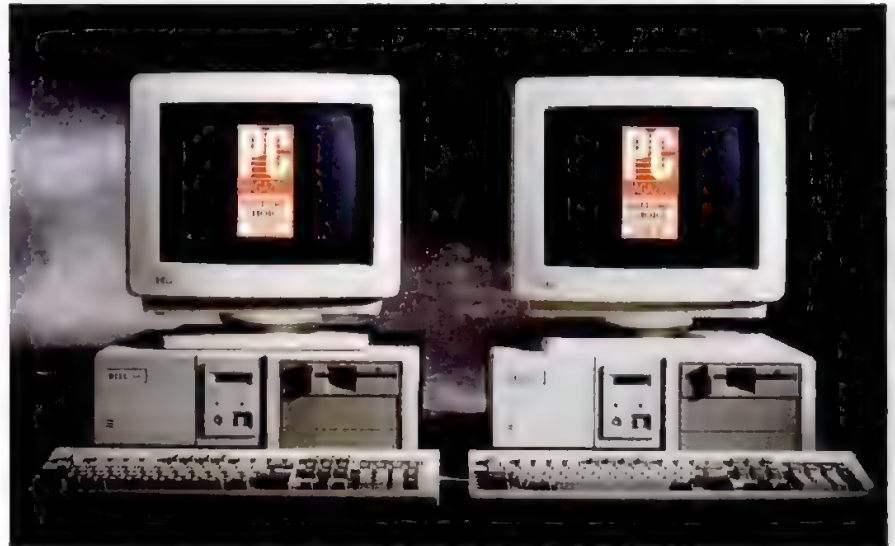
than a similarly configured Compaq, and the 333D is

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Then there's Dell's impressive service record for which we've won *PC Week's* Corporate Satisfaction Poll for PCs, laptops and server, an unprecedented 8 times.

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That's why, no matter what you need, from answering any kind of technical or service question, to help in custom configuring your new computer, we'll

THE DELL 333D 33 MHz 386 SYSTEM AND THE
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- Integrated hard drive and diskette drive interface.
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*Performance Enhancements: Within the first megabyte of memory, 96 KB of memory is reserved for use by the system to enhance performance. Can be optionally disabled. All prices and specifications are subject to change without notice. Dell cannot be responsible for errors in typography or photography. Source: Compaq Computer Corporation price list effective 2/11/91. **Payment based on 36-month, open-end lease. *Leasing arranged by Leasing Group, Inc. In Canada, configurations and prices may vary. Dell and Dell System are registered trademarks and SmartVu is a trademark of Dell Computer Corporation. 386 is a trademark and Intel is a registered trademark of Intel Corporation. Other trademarks and trade names are used to identify the entities claiming the marks and names of their products. Dell Computer Corporation disclaims any proprietary interest in trademarks and trade names other than its own. On-site service provided by Xerox Corporation and may not be available in certain remote locations. Shipping, handling and applicable sales tax not included in this price. For information on and a copy of Dell's 30-Day Total Satisfaction Guarantee, limited warranty, and Xerox's Service Contract, please write to Dell USA Corporation, 9505 Arboretum Blvd., Austin, Texas 78759-7299, ATTN: Warranty. ©1991 Dell Computer Corporation. All rights reserved.

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21 homes.



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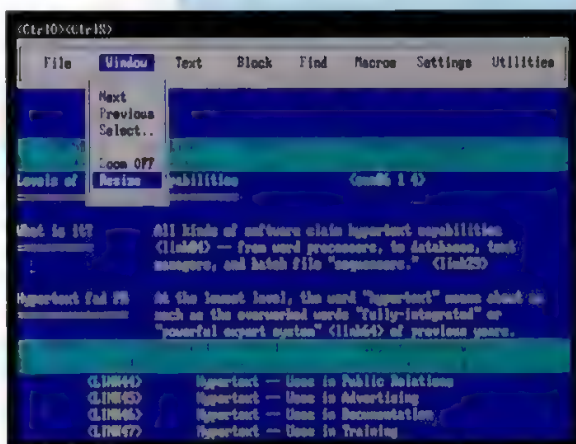
SOFTWARE HYPERTEXT

Text is as simple as placing angle brackets on either side of a filename embedded in text. You can link text within or between files, or target a link to a screen (page) number, line of text, or specific word. The links are activated in *TransText* when you enter the link mode by pressing F4. You can create links to and from an illustration or a .PCX or Color-TX image. That's all. You can't link directly to other applications, video, sound, or animation.

These types of links are absent because the developer of *TransText*, Neil Larson, believes that knowledge is most effectively transferred through text. Larson puts a personal stamp on all MaxThink products, especially through the conversational documentation, which includes his opinions and suggestions on building hypertext applications.

The search facilities in *TransText* and the runtime readers are kept simple. All you can do is search for a particular word or phrase up to 60 characters long. You can't use Boolean connectors or search by proximity, which is in keeping with Lar-

The links in *TransText* appear as a filename surrounded by angle brackets. A link can indicate the screen and line number as well. In the link <sum06 1 4>, sum06 is the filename, 1 is the screen number, and 4 is the line number. *TransText* can have up to six windows at a time, all of which can be resized.



son's position that searching is the wrong approach to finding information. He cites studies showing that searches access only approximately 20 percent of the information that is available on a subject. Larson's approach is to break down information into small, thoughtfully cross-linked file



HYPERTEXT PROGRAMS: SUMMARY OF FEATURES

Products listed in ascending price order

	TransText	xText	Hyper-Word
FILE IMPORT/EXPORT			
Text files	ASCII, WordStar	ASCII, Microsoft Word, WordPerfect	ASCII, comma-delimited, Microsoft Word, PFS:Professional Write, WordPerfect, WordStar
Graphics files	.PCX	None	None
PRINTING			
Supports PostScript printers	☐	☒	☒
Prints selected text	☒	☐	☒
Prints current page	☒	☒	☒
Prints entire document	☒	☐	☒
Can control line spacing	☒	☐	☒
Can control margins	☒	☐	☒
Has page-numbering feature	☒	☐	☒

—Editors' Choice ☒—Yes ☐—No

N/A*—Not applicable: The product does not have graphics capability.

N/A*—Not applicable: The product is word processor dependent.

FACT FILE

TransText,
Version 90
MaxThink, 44 Rincon
Rd., Kensington, CA
94707; 415-540-
5508.

List Price: \$89

(includes free
standalone and network runtime readers).

Requires: 180K RAM, DOS 2.0 or later.

In Short: *TransText* is a hypertext word
processing program. It only lets you link to text
and graphics. Graphics can't be manipulated
in the program. To get the full use of
TransText you have to use a group of utilities,
which makes the product somewhat awkward.

CIRCLE 400 ON READER SERVICE CARD

perthext manual, *DOS Help!*, was awarded
a *PC Magazine* Editors' Choice award
and was followed by *TECH Help!*, a sys-
tem-level reference manual for PC pro-
grammers. Prompted by the success of
these manuals, Flambeaux brought *xText*
to the end-user market, making the au-
thoring tool available to anyone who
wanted to write a hypertext help system.
Priced at \$139.95, it's an inexpensive way
to get a hypertext authoring application
without paying for a lot of features you
may not need.

xText is best suited for building help
manuals that can run in a standalone or
memory-resident mode. It doesn't sup-
port interactive editing or links to graph-
ics, other media, or applications, and it's
limited even within the context of a simple
hypertext document. You won't find an
automatic index, specific word or phrase
search, or flexible viewing options.

YOUR OWN WORD PROCESSOR

xText is made up of two distinct pieces—a
compiler and a reader—but you work
interactively only with the reader. The
entire authoring process takes place in
your own word processor where you write
documents and embed *xText* commands.
You create a hypertext link by placing
tildes before and after a word or phrase.
The compiler then turns the document

SUITABILITY TO TASK

xText

Reading	☒	☐	☐	☐
Authoring	☐	☒	☐	☐
Multimedia	☐	☐	☐	☐
Application development	☐	☐	☐	☐

into a hypertext document with chains of
linked text.

Your document must have at least three
pages. The first page is for a logo, which
the program displays when you start your
hypertext manual. The second page is for
auto-lookup. It contains a list of all the
link references so they can be matched to
a help request. If there is a match, the
reader is brought right to that spot in the
manual. The third page is the main menu.
It's the starting point for hypertext paths
and serves as the top level for reading. The
reader can get there immediately from
anywhere in the document by pressing F2.

You format documents with *xText* dot
commands, such as .P for identifying a
new page. Other dot commands let you
add hidden comments or name elements
of the file. For example, the .N command
gives the manual a name, which the pro-
gram displays in the upper-left-hand cor-
ner of the screen. The .A command lets
you define synonyms for page names,
such as AP for Accounts Payable.

All other editing and formatting func-
tions depend on your word processor. The
program comes with two special print-to-
disk drivers, one for *Microsoft Word* 5.0
and the other for *WordPerfect* 5.0. If you
use either of these two programs, you can
use a full range of word processing fea-
tures, including tab stops, hanging in-
dents, multiple columns, variable mar-
gins, headers, and footers. If you're using
another word processor, you'll have to
convert your file to ASCII and lose all for-
matting.

COMPILE AND READ

Before you can read a completed docu-
ment, you must run it through the *xText*
compiler. Working behind the scenes, the
compiler runs from the DOS prompt. You
type XTC [infile name] [outfile name]
followed by any number of "/" com-
mands. The slash commands instruct the
program to display full error messages,
remove tilde link marks rather than re-
place them with spaces, allow for docu-
ments over 250 pages and over 255 lines,
or override the default hotkey for mem-

units.

You can use *TransText* for both simple
and complex hypertext applications as
long as they are mostly text-oriented.
While the linking mechanism and word
processing features are easy to use, the
collection of programs and utilities makes
TransText a difficult program to under-
stand and fully utilize, and the documen-
tation doesn't help much to make things
clearer.

xText

xText remains wedded to its original pur-
pose as a tool for building hypertext
manuals. Flambeaux Software's first hy-

Hyperties



HyperWriter

Guide

SmarText

Folio VIEWS
Professional
Edition

ASCII

ASCII

ASCII

Ami Pro,
ASCII, Microsoft
Word, WordPerfect

ASCII, comma-
delimited,
Microsoft Word,
WordPerfect

.PCX

.PCC, .PCX

.BMP, .DIB, .MSP,
.PCC, .PCX, .TIF,
Windows Metafile

.BMP, .CGM, .PCX, .PCX
.PGL, .PIC, .SDW,
.TIF

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ENDS

SOFTWARE HYPERTEXT



Links in *xText* can only be within text in the current file. A link is indicated by text in a highlighted color—white in the screen shown here. The cursor moves from link anchor to link anchor with the arrow keys. You can have two other highlight colors for text—yellow and red are used here—to emphasize a word or phrase.

ory-resident mode. A compiled manual includes all the links, the source text (in compressed form to save disk space), and an error summary.

Because *xText* is narrowly focused, there are only a few commands you need to know. The arrow keys move you from link to link and scroll the page; the F1 key takes you to a list of function-key commands; F3 turns the page, as do the Plus and Minus keys; the F5 key toggles window size and position; and the F7 key allows a reader to select new colors for every part of the screen and text.

xText comes with a free, unlimited distribution license, so there are no royalties to pay for passing out the manuals you build and an accompanying copy of the



FACT FILE

xText, Version 1.0
Flambeaux Software Inc., 1147 East Broadway, #56, Glendale, CA 91205; 800-833-7355 ext. 1233, 818-500-0044.
List Price: \$139.95.
Requires: 256K RAM, DOS 2.1 or later.
In Short: Essentially a compiler, *xText* is best suited for building help systems, which is why it was first created. You can't link to graphics, applications, or other media.



CIRCLE 407 ON READER SERVICE CARD

reader. If you want to design hypertext documents with stronger searching and navigating abilities, or more flexible linking, then this is not the program for you. But for the focused task of creating a hypertext help manual, *xText* is a simple program worth considering. ■

Henry Fersko-Weiss is a frequent contributor to PC Magazine.

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—PC Magazine, June 12, 1990

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ENDURANCE TESTS.....

33-MHz 386 PCs

by Tom Unger



A scant year ago, 386/33s were the power platforms to envy. Now facing stiff competition from 486/25s and 486/33s, CompuAdd, Dell, Polywell, and Zeos prove themselves in our latest round of endurance tests.

Since the 33-MHz 386 was introduced nearly three years ago, more than 115 models have been sent to market. Now, facing steady downward price pressure from a growing list of 486/25s and 486/33s, the 33-MHz 386 has kept a firm grip on the high-end workstation market. With base prices starting 20 to 30 percent below the cost of the nearest 486-based PC—and as much as 50 percent below the average cost of a 33-MHz 386 18 months ago—today's 33-MHz 386 appears to be the processor of choice for those who don't want or need the \$500 or so expense of a built-in math coprocessor.

Because we are never content to review and forget, *PC Magazine* presents the results of long-term evaluations of four of the best 33-MHz 386s from our last review. In our endurance test group are the CompuAdd 333T, the Dell System 333D, the Poly 386-33PT, and the Zeos 386-33. Each of these machines was an Editors' Choice except the Poly 386-33PT, which snagged an honorable mention.

HORSEPOWER

In order to put these PCs through their paces, we asked their vendors to send us machines that were configured as you might put a machine of this power to work. Accordingly, each PC came with 4MB of RAM, a 200MB hard disk or larger, and a Super VGA display subsystem, including a Super VGA monitor capable of showing 1,024 by 768 color pixels. Each machine we reviewed also came with two high-density floppy disk drives and an internal tape backup system and accompanying software, as well as DOS 4.01 and *Microsoft Windows 3.0*. Polywell's machine also packed an NEC Intersect internal CD-ROM reader.

The Dell System 333D—the only system that arrived in a desktop case—came with an OmniTel Encore 2400HB internal modem, and the Zeos 386-33 came with a Cardinal SendFax Modem board. With these extras installed, our test subjects had prices ranging from the Dell System 333D's high of \$7,196 to the Zeos 386-33's low of \$5,492. The Poly 386-33PT and CompuAdd 333T fell in the middle at \$6,950 and \$6,263, respectively.

Note that these 33-MHz 386 prices are considerably lower than the average prices of comparably configured computers just a year ago. Even better, the machines we looked at were truly loaded. For those on a tighter budget, basic configurations with 1MB RAM, a 40MB or 60MB hard disk, one floppy disk drive, and a VGA subsystem can be found in the neighborhood of \$2,500—a small price to pay for this kind of computing power.

EVERYDAY TASKS

For this series of endurance tests, we asked our reviewers to use these machines as they would the machines they had been using every day. We supplied them with a wide variety of software that could simulate the kinds of demanding computing tasks to which computers might be subjected in any business environment: communications, desktop publishing, graphics,

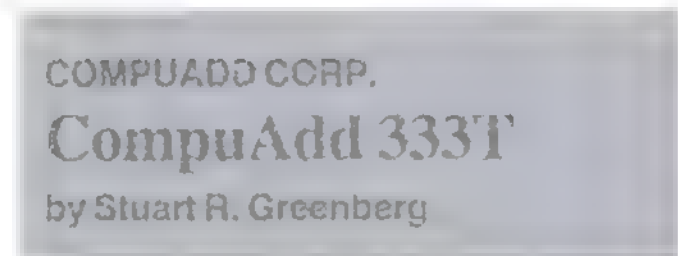


presentations, spreadsheets, word processing, and *Microsoft Windows 3.0* applications.

We also asked our reviewers to think about the kinds of complications that matter little in a one-week trial but can add up to a major headache a month or three months down the road. We wanted to know the effects of a new software package on the rest of the system, whether the keyboard cable that came with the system was of sufficient length to allow the machine to move off the desktop, whether the fan made a peaceful background hum or sounded as if a swarm of mosquitoes had taken over the office. We wanted to know if removing the computer's case to add a new board or change a jumper caused excessive hair-tearing, or if it really was as simple as the documentation claimed—assuming, of course, there *was* documentation included.

We switched boards and added others, changed environment variables, and connected to our internal network. We warm-and cold-booted these machines dozens of times during the day and then left them on all night, pushing them to their extremes. In short, we attempted to recreate the kind of environment in which a high-performance 33-MHz 386 might find itself in any office, where ruggedness, design simplicity, and ease of use count.

What follows is a detailed description of how these four PCs fared in rigorous daily use. Our reviewers determined whether these computers really are the level of machine to pick if you need full power in a business computer.



You can't judge the CompuAdd 333T by its cover. Even the view inside the ubiquitous tower case does not appear unusual at first glance. But with DOS and *Microsoft Windows 3.0* preloaded, the CompuAdd 333T is not just ready to run, it's ready to boogie.

I put this speed demon through its paces in a typical programming environment. As expected, the 333T seemed faster than oth-

er machines I've used. It loaded programs almost instantaneously and sped up the typical edit/compile/test cycle significantly. Even the time required to reboot the system was short: The 333T took just 15 seconds from power-on to the C:\> prompt. By contrast, my own 16-MHz 386SX system takes more than 90 seconds to cold-boot.

UNDER THE HOOD

The 333T's motherboard contains one 8-bit and six 16-bit slots, a dedicated 32-bit memory slot, and an additional dedicated slot. Our \$6,263 endurance-test machine also came with 4MB of memory (expandable to 16MB), 64K of 15-nanosecond cached RAM, a 150MB Seagate hard disk, a 1MB caching disk controller, a CompuAdd Hi-Rez VGA card with 1MB of RAM, one 1.2MB 5.25-inch and one 1.44MB 3.5-inch floppy disk drive, one parallel and two serial ports, a socket for an 80387 or Weitek 3167 math coprocessor, a Phoenix BIOS, and a total of nine half-height drive bays.

Further examination reveals that the 333T comes equipped with two high-speed slots, one for the caching disk controller and the other for the VGA adapter. By altering the wait states in these slots, a compatible board gets a speed boost equivalent to a 50 percent increase in bus speed. There is also a dedicated slot containing an optional 640K SRAM board, which allows conventional DOS memory to run without wait states.

BIG PERFORMER

Microsoft Windows 3.0 performance—barely tolerable on slower machines—was a pleasure on the 333T. The large sample drawings that come with *CorelDRAW* still took a long time to process, but my own less complex drawings quickly took shape and printed.

I used 386MAX to load the 4DOS COMMAND.COM replacement, UltraVision VGA enhancer, and Microsoft Mouse driver into high memory. This left a comfortable 585K of conventional memory available for DOS.

I was particularly surprised to discover that I didn't need some of the typical speed-improvement programs required to get reasonable response out of other systems. A software disk cache like *Super PC-Kwik*, for example, did not provide the spectacular speed increase that is common with slower machines. I found the system's caching controller more than ade-



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high refresh rate
Scan Frequency: Automatic Adjustment
H: 30-64kHz V: 50-90Hz
VGA, 8514/A and Mac II Compatible

quate by itself. I decompressed several archived files using *PKZIP* and *Lharc* and was amazed at how quickly both utilities could process files. A 400K *Lharc* file, which took 76 seconds to expand on my 16-MHz 386SX machine at home, took only 28 seconds on the 333T.

SMOOTH OPERATOR

Although the hard disk provides fast access, the 333T operates so quietly that the disk's lack of a light made it hard to tell



when it was being used.

With a much stiffer feel than most keyboards I've used, the CompuAdd keyboard took a bit of getting used to. Some keys required a particularly heavy hand to activate. The Left Shift key and Cursor Down keys were the biggest nuisances.

The \$6,263 price tag for the configuration I tested is a bit steep for a programmer's machine, but you could start with a bare-bones system for \$2,775 or a basic VGA system for as little as \$4,175 and work your way up. You'll have a hard time outgrowing the 333T. If you need a system for demanding programming, CAD/CAM, graphics, or other CPU-intensive tasks, the CompuAdd 333T may just be the power tower you're looking for.

CompuAdd 333T

CompuAdd Corp., 12303 Technology Blvd., Austin, TX, 78727; 800-627-1967, 512-258-5575. **List Price:** With 4MB RAM, 64K processor RAM cache, 153MB hard disk, Mountain Hardware 150MB tape backup, 1.2MB 5.25-inch and 1.44MB 3.5-

inch floppy disk drives, Super VGA display subsystem with 1MB RAM, one parallel and two serial ports, DOS 4.01, *Microsoft Windows* 3.0, serial mouse, 2,400-bps internal modem, \$6,263.

CIRCLE 603 ON READER SERVICE CARD

DELL COMPUTER CORP

Dell System 333D

by Tom Unger

When we last reviewed the Dell System 333D in the January 15, 1991, issue of *PC Magazine*, its Editors' Choice status was not based on any single outstanding characteristic. It garnered top honors because of its overall quality, reliability, and "vast capabilities." Six months and who-knows-how-many megabytes of computing later, we're happy to say that its capabilities are indeed vast.

The unit we tested this time came with 4MB of fast RAM on a single 4MB SIMM, and 64K of 25-nanosecond processor cached RAM, all located on the Dell-designed motherboard. Although a

CompuAdd 333T

Last Reviewed:
December 25, 1990,
page 161.

Reason Selected:
Editors' Choice.

Positive Findings:
High-speed processor,
hard disk, and video;
quiet operation;
convenient tower design
with ample room for
expansion

Negative Findings:
Stiff keyboard, no status
light for hard disk.

↑ RELIABILITY

↑ COMPATIBILITY

↑ PERFORMANCE

It's the fastest But it will never cat

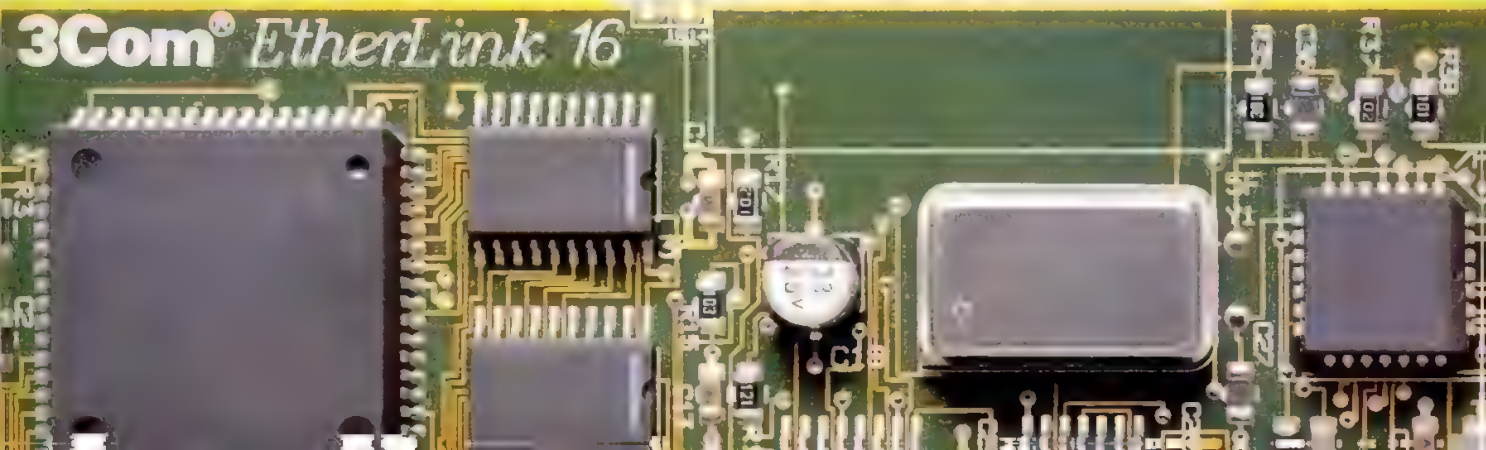
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\$3,399 basic System 333D comes with 1MB RAM, a 40MB IDE hard disk, one floppy disk drive, and color VGA, our \$7,196 system had a 190MB IDE Maxtor hard disk (mounted in a 3.5-inch internal drive bay) and two floppy disk drives (one 1.2MB 5.25-inch and one 1.44MB 3.5-inch). It also contained a Wangtek 150MB internal tape backup system, a Dell GPX-1024 Graphics Performance Accelerator 1,024-by-768 video card that drove a Dell 16C Super VGA monitor, and a 2,400-bps OmniTel Encore 2400HB modem. Apart from the need for an 80387 math coprocessor, it is hard to imagine a better high-end workstation—short of an 80486-based computer.

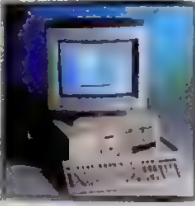
THE DESKTOP'S DESKTOP

Although you might make do with the System 333D as a small server, its real strength is as a desktop workstation. One of the System 333D's best features is its midsize desktop case; measuring 6 by 16 by 16 inches, it was a small but welcome visitor on my desk. Half the time I set it on its four solid feet; the rest of the time I stood it on its side, in which position it ran without so much as a hiccup. Without a

ENDURANCE TESTS

33-MHz 386 PCs

Dell System 333D



Last Reviewed:
January 15, 1991,
page 280.

Reason Selected:
Editors' Choice.

Positive Findings:
Excellent ergonomics and expansion capabilities, midsize case, quiet cooling fan and hard disk, easily accessible setup screen.

Negative Findings:
No keyboard-controlled password, short PS/2-style keyboard cable, too many manuals.

↑ **RELIABILITY**

↑ **COMPATIBILITY**

↑ **PERFORMANCE**

math coprocessor, but with the aid of the Dell GPX-1024 video card, it ran *Microsoft Windows 3.0* applications such as *CorelDRAW*, *ImagePrep*, and *Microsoft's PaintBrush* quite speedily.

You can save yourself \$999 if you don't need a high-performance graphics card; Dell's motherboard includes integrated

Super VGA, and it performed beautifully in both 640- by 480-pixel mode (256 colors) and 1,024- by 768-pixel mode (16 colors). This saves you an expansion slot—one example of the System 333D's strong expansion capabilities. Responding to earlier requests, Dell has included one parallel and two serial ports on the motherboard, as well as a PS/2-style mouse connector. Although I used up all the drive bays, it is unlikely that you'd need another one.

NO CHOKE

All of these motherboard-based items add up to serious expandability. With one 8-bit and five 16-bit full-length ISA expansion slots, this machine leaves you a wide upgrade path. Eventually I filled every slot, and I was reassured to note the variety of hardware the System 333D could accommodate without choking. I experienced nary an interrupt problem.

Along with the tape drive controller and the Dell GPX-1024 card, I plugged in a SoundBlaster card (with game port), a Bernoulli controller card, a network card, a bus mouse card (for a non-PS/2-style Microsoft Mouse), and a 2,400-bps inter-

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because there are no jumpers to slow you down.

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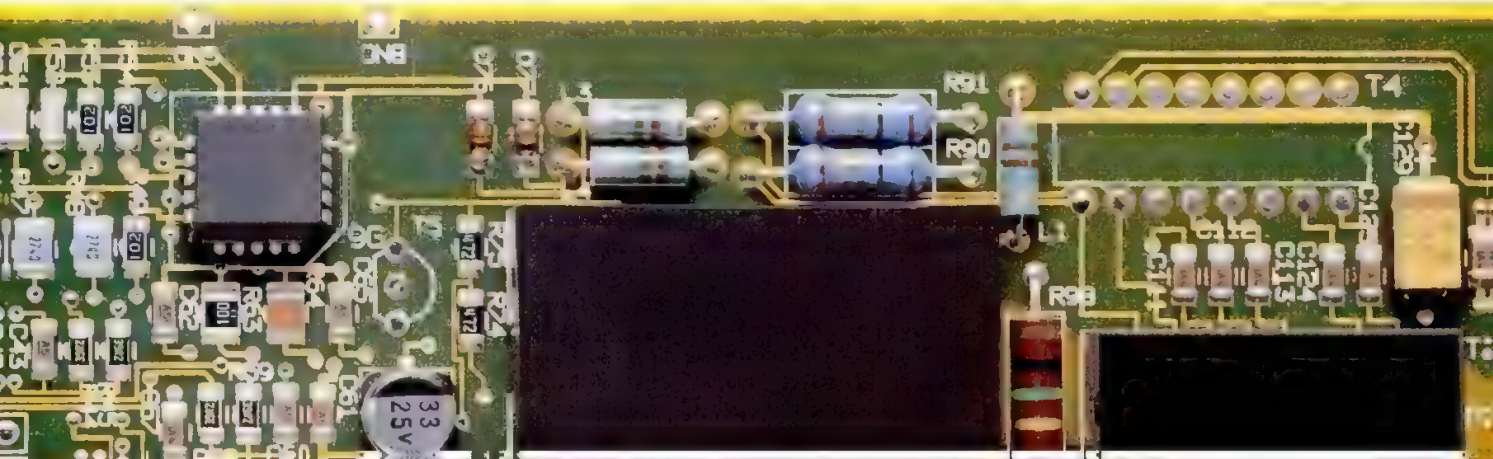
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nal OmniTel modem (with *ProComm Plus*). I switched from application to application under *Windows*' Enhanced mode and noticed no performance degradation. The tape backup system worked equally well.

NO-HASSLE TINKERING

For those of you who like to open the case and move components around, you'll find the System 333D accommodating. Dell provides thumbwheel screws on the back of the case, allowing you to open the machine without a screwdriver (although the thumbwheel screws do have regular screwdriver slots for those with weaker fingers). Each slot in the case is easily accessible, and although some motherboard components are hidden by the power supply, the coprocessor slot and system DIP switches are accessible without much of a hassle. And those switches are all clearly diagrammed on a decal inside the case, affixed securely to the top of the machine's power supply.

PICKY, PICKY

This machine's general finesse makes some lesser details stand out. For example,



the 101-key Enhanced keyboard had an excellent, clicky feel, but I wished it had come with an extension cord for its PS/2-style connector—a not-so-easy-to-find item.

The System 333D comes with copious, easy-to-read documentation. But instead of two or three orderly volumes, Dell includes one boxed set of four, including a DOS 4.01 manual as well as a user guide and a troubleshooting and diagnostics manual. Add software installation guides for the WangTek tape backup, the on-board Super VGA, the GPX-1024 Graphics Performance Accelerator, and the modem, and you're swimming in manuals. For a company that pays such careful attention to detail, this seemed out of the ordinary.

Finally, although the system can be set to prompt for a ROM-based password before or after boot-up, you will need to run a Dell utility called KP.EXE if you want to lock the keyboard after you've started to work. Unfortunately, KP.EXE works only

from a batch file or the DOS prompt. Unlike PCs that let you invoke the system password via a key combination, this one compels you to quit whatever you're doing—especially if you are running *Windows*. TSRs will continue to run in background mode when the keyboard-lock program is invoked.

These are small criticisms indeed for a system that ran so well and speedily throughout our endurance test period. If you are in the market for a high-end 386-based machine from a proven vendor, you need look no further than the Dell System 333D.

Dell System 333D

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; 800-426-5150.

List Price: With 4MB RAM, 190MB IDE hard disk, 150MB Wangtek tape backup, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, Dell GPX-1024 Graphics Accelerator Super VGA card with 1MB VRAM, Dell 16C 16-inch Super VGA monitor, one parallel and two serial ports, one PS/2 mouse port, DOS 4.01, *Microsoft Windows* 3.0, 2,400-bps OmniTel Encore 2400HB modem, \$7,196.

CIRCLE 604 ON READER SERVICE CARD

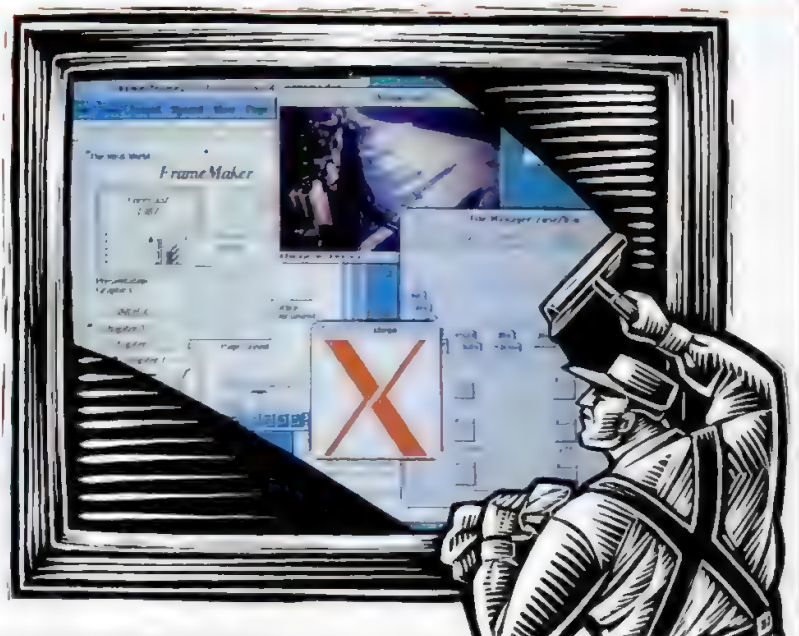
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CIRCLE 171 ON READER SERVICE CARD

TEST PATTERN.



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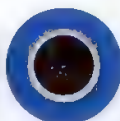
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"The MultiModemV32 can be configured for almost any application, it works under severely impaired lines, and it wins first prize for fast data transfers."

PC Magazine, 12/11/90, Ziff Davis Publishing, "9600 BPS MODEMS: Break
up the speed barrier PC LANs, trends toward rapid-fire modems complying
with V.32/V.42 and V.42bis standard."

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CIRCLE 108 ON READER SERVICE CARD

POLYWELL COMPUTERS INC.

Poly 386-33PT

by Oliver Rist

The \$6,950 Poly 386-33PT is a bouillabaisse of power, speed, and name-brand ingredients. But as with any recipe, the amount of stirring required may prevent all but the most experienced chefs from enjoying the meal.



Our review configuration was not for dieters. The Polywell-designed ISA motherboard included a Phoenix BIOS, 4MB of RAM, and a 64K static RAM cache. The machine came with a 200MB 14-millisecond Maxtor ESDI hard disk connected to a DTC 6280-15XT ESDI controller with a

32K buffer, and 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives. A SpeedStar graphics adapter with 1MB of VRAM drove a 14-inch-diagonal Seiko Instruments CM-1450 high-resolution monitor. Polywell also provided one parallel and two serial ports, one PS/2-style mouse port, an internal NEC Intersect CD-ROM reader, an internal Wangtek 150/250MB tape drive, and a 101-key Chicony keyboard, along with DOS 4.01, OS/2 1.2, Sytos tape backup software, and Microsoft Windows 3.0, as well as a Magic Mouse with its I/O card. A full-size 25- by 8.8- by 20.3-inch tower case held the 386-33PT's components.

NOT ALL THERE

Unfortunately, this impressive configuration had problems. Polywell may have confused the internal modem we requested with a math coprocessor. Neither one was installed in our test machine, but the coprocessor's cost was originally included in the unit's list price.

Polywell did not forget the 386-33PT's documentation, but what the company sent for the motherboard was full of misspellings and cryptic sentences. Worse, Polywell failed to include manuals for the tape drive, the monitor, and the hard disk controller. After a phone call, Polywell promptly sent all the missing elements.

PAIN IN THE MOUSE

The NEC CD-ROM reader's documentation failed to tell us about an elusive DMA jumper setting on its SCSI adapter card. Once I located the jumper, the CD-ROM worked flawlessly. Not so the Magic Mouse. This three-button rodent's driver seemed to disappear from memory when I ran Windows or any of a variety of communications packages. I tried different mouse solutions, including another bus mouse and a serial version, but the problem remained.

BAR THE DOOR

The tower case was so wide that it didn't need its included case stand. Nor did it need its front drive-bay door. This little plastic horror blocks access to all the drives and the unit's front-mounted switches. There was no obvious way of removing the door without breaking it. A door might be fine for protecting LAN servers from curious fingers, but it is annoying on a workstation.

The interior of the case had plenty of breathing space. The unit sports five half-

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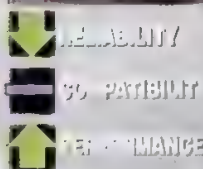
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CIRCLE 160 ON READER SERVICE CARD

Poly 386-33PT



Last Reviewed:
January 15, 1991,
page 327.
Reason Selected:
Honorable mention.
Positive Findings:
Solid brand-name components, good speed, large case with room for six half-height drives.
Negative Findings:
Interrupt problems, disappearing mouse driver, poor proprietary motherboard manual, no manuals for third-party components.

height, front-access drive bays as well as two full-height internal bays. Four of the front-access bays were taken by the Wangtek tape drive, the two TEAC floppy disk drives, and the NEC Intersect CD-ROM reader. One of the internal bays was needed to hold the full-height Maxtor hard disk. This left one half-height and one full-height bay for expansion.

Of the motherboard's two 8-bit and six 16-bit ISA slots, six were taken up by the ESDI controller, the graphics adapter, the SCSI CD-ROM controller card, the Wangtek controller, our network card, and the Magic Mouse I/O card.

HOT UNDER THE TOWER

I installed a Geniscan GS-4000 hand scanner with no difficulty, but I'm glad I didn't have to install any drives. The drive bays are separated from the rest of the system by sturdy steel bars in back and blocked in the front by the system's faceplate. To get at them you would have to spend some quality time with your screwdriver.

I also encountered a heat problem. Even with Polywell's two-fan power supply, after I left the 386-33PT on for 6 or 7 hours, the temperature in my office rose noticeably. When the machine was on for 9 or 10 hours it would crash more often. And when the CPU was really warm, the display would blank out, and nothing short of a cold reboot or a tap on the reset switch would bring it back.

After these experiences, it was time to contact Polywell technical support. Without mentioning my *PC Magazine* connection, I informed the support technician of my problem with the Magic Mouse. After scrutinizing my AUTOEXEC.BAT and CONFIG.SYS files for a day, the Polywell representatives were unable to find a fix. Although surprised, they agreed with my



diagnosis of the heat problem, but they were unable to suggest a solution.

Aside from the heat-related difficulties and the mouse anomalies, I encountered no software-compatibility problems. *Alpha4*, *Lotus 1-2-3*, *Lotus Express*, *Microsoft Windows 3.0*, *Sidekick 2.0*, *WordPer-*

fect 5.1, and *XyWrite III Plus* ran without difficulty. The 386-33PT proved equally capable with high-end applications. *ImageIn*, *Micrografx Designer*, and *Page-Maker 3.0* ran quickly, even with larger color-intensive images.

The Poly 386-33PT ran speedily, albeit with some bumps along the way. Once you're over the price hurdle and have spent a few hours knocking the system into shape with tech manuals and screwdrivers,

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Poly 386-33PT

Polywell Computers Inc., 61-C Airport Blvd., S. San Francisco, CA 94080; 415-583-7222. **List Price:** With 4MB RAM, 200MB Maxtor hard disk, Wangtek internal 150MB tape backup, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, SpeedStar High-Resolution Graphics Adapter with 1MB VRAM, Seiko CM-1450 14-inch monitor, one parallel and two serial ports, one PS/2 mouse port, DOS 4.01, OS/2 1.2, Microsoft Windows 3.0, Sytos tape backup software, 2,400-bps internal modem, NEC Intersect internal CD-ROM reader, \$6,950.

CIRCLE 605 ON READER SERVICE CARD

ZEOS INTERNATIONAL LTD.

Zeos 386-33

by Lori Grunin

The Zeos 386-33, a tower machine, proved a welcome and trouble-free tool for accomplishing the troublesome computing



tasks I faced during the past six months. It also proved itself adept with my everyday jobs, which demand less power. And at \$5,492, it was the least expensive of our four endurance-test machines.

Our long-range test configuration included a Mylex motherboard with Phoenix BIOS, 4MB RAM, 128K processor RAM cache, 200MB hard disk, one 1.2MB 5.25-inch and one 1.44MB 3.5-inch floppy disk drive, and a Cardinal SendFax Modem card. For my needs, which centered primarily around memory- and megabyte-hungry graphics applications, I would have preferred 8MB RAM (the machine can hold up to 32MB) and a second hard disk in one of the six half-height drive bays. The Zeos 386-33 also has a hidden 3.5-inch bay.

GRAPHICS TASKS

I used the Zeos 386-33 primarily as a graphics workstation, souping it up a bit by dropping in a \$1,995 optional Weitek 3167 floating-point coprocessor and hook-

ing up a Microtek color scanner. The Super VGA card I used, the noninterlaced SpeedStar VGA with 1MB VRAM, performed exceptionally well in high-resolution 256-color mode, and the rendering times with Autodesk's *3D Studio* were surprisingly short. Similarly, I found the computer's performance with products such as *CorelDRAW* and *Micrografx Designer* beyond reproach; screen redraws took markedly less time than they would with my usual combination of a 20-MHz 386 and a NEC MultiSync Graphics Engine.

The 16-millisecond cached hard disk was acceptably fast for manipulating large (10MB to 22MB) graphics files, and I experienced no problems transferring those files to a portable computer via the parallel port. Nor did any incompatibilities or unexpected difficulties crop up, even when I was running beta software or installing an old Targa32 board without the documentation.

The Zeos 386-33 never gave me occasion to contact the company for technical support, although at one point I did call Diamond Computer Corp., makers of the VGA card, regarding a problem installing



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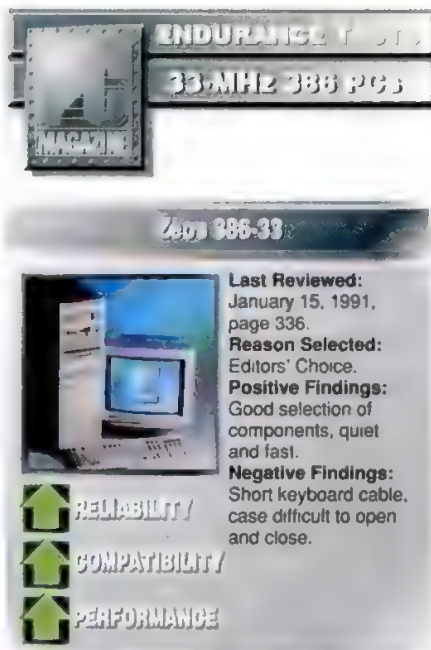
quickly, it also communicates clearly. The 9600EX knows when data is being garbled and automatically retransmits, so your data arrives error free.

Plus, the 9600EX features full-compliance with V.32 and is downward-compatible with slower modems. And, like our entire family of modems, the 9600EX comes with a full, five-year warranty.

the *Microsoft Windows* 3.0 video driver. The source of the problem was an omission in the documentation: The manual neglected to say that the driver files had to be copied into the \WINDOWS\SYSTEM subdirectory before installation—a fact that technical support managed to convey in about 2 minutes without playing the usual game of twenty questions. Similarly, although I had trouble getting through to Diamond's BBS the first time—the line was busy all day—I had no problems on subsequent trials.

A CASE FOR BETTER DESIGN

Although I encountered few problems with the Zeos 386-33, I do have a few complaints about the nonelectronic parts the company chooses to use in constructing the machine. For instance, the case—a model that seems to be popular among tower units these days—is difficult to remove and replace. You have to squeeze it between your knees to keep the sides aligned with the screw holes while putting the cover back on—a rather ludicrous position for the owner of such a powerful piece of equipment to be in. A removable or hinged side panel, such as those used by



ALR or the tower PS/2s, would have been a preferable design.

More frustrating, the keyboard cable measures somewhere between 4 and 5 feet, which just isn't long enough for a tower machine that sits next to the desk. Again, this is a standard length chosen by many PC vendors, but a daily source of an-

noyance in my cramped office. It may be worth your while to ask Zeos for a keyboard with a longer cable, or to make sure you have an extension handy.

The Zeos 386-33 has been a relatively trouble-free machine. While the 486 processor and its built-in math coprocessing circuitry are preferable for the kinds of screen and floating-point-intensive operations for which I used the system, this computer more than lived up to its Editors' Choice designation.

Zeos 386-33

Zeos International Ltd., 530 5th Ave. NW, St. Paul, MN 55112; 800-423-5891. **List Price:** With 4MB RAM, 160MB hard disk, 40MB internal tape backup, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, SpeedStar Super VGA card with 1MB VRAM, NEC MultiSync 4D monitor, one parallel and two serial ports, DOS 4.01, *Microsoft Windows* 3.0, *Microsoft Mouse*, Cardinal SendFax Modem card, \$5,492.

CIRCLE 808 ON READER SERVICE CARD

Stuart R. Greenberg is senior programmer at PC Magazine Labs. Lori Grunin is a project leader at PC Magazine Labs. Oliver Rist and Tom Unger are staff editors of PC Magazine.



Just a second.

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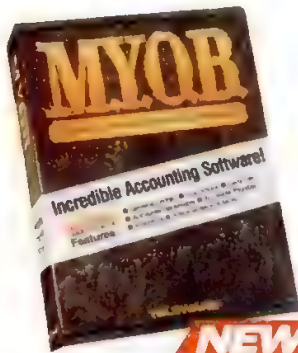
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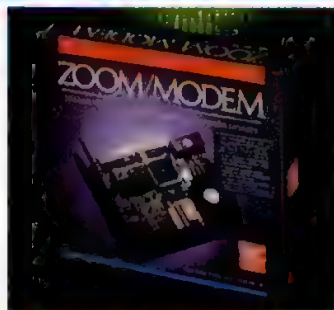
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(Dariana Technology Group) A systems analysis tool for Microsoft Windows 3.0, WinSleuth allows the user to probe the Windows 3.0 environment. TuneUp examines the Windows environment and the system's hardware and makes recommendations on optimizing the Windows installation. Reveals details about Windows device drivers in use and helps resolve any conflicts. Includes on-line help and prints results. **UT1704 \$85.**

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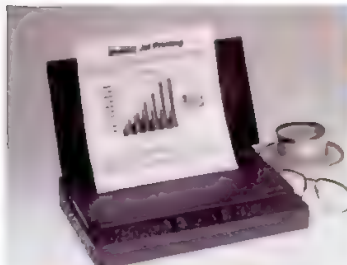
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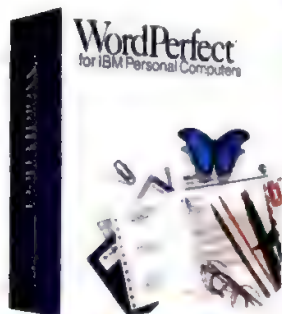


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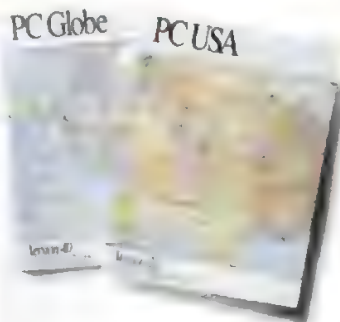
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BS3423/5	Ko-Pilot for Lotus 1-2-3 79.
BS3413/5	Ko-Pilot for WordPerfect 5.1 79.
BS3433/5	Ko-Pilot for WordPerfect 5.0 79.
Inner Media, Inc.	
UT1754	★ Wide Angle 65.
Inset Systems	
UT1614	Hijaak 2.0 99.
Intuit	
FN0164	Quicken 4.0 37.
Iris Associates	
BS0914	★ 3 for 3 84.
Jacoby & Meyers Law Offices	
BS2923/5	WillPower 32.
Lifetree	
BS3104	Correct Grammar 3.0 59.
Lotus	
BS3174	Agenda 2.0 288.
GR0864	Ami Pro 1.2 305.
BS1473/5	Lotus 1-2-3 Rel. 2.2 339.
BS2433/5	★ Lotus 1-2-3 Rel. 3.1 419.
BS2323/5	Symphony 2.2 519.
Magee	
UT0844	AutoMenu 38.
Meca	
FN0243/5	Managing Your Money 7.0 135.
Merrill & Bryan	
UT1654	★ Turbo EMS 6.0 56.
Microcom	
CM0083/5	Carbon Copy Plus 5.22 115.
Micro Logic	
BS2144	InfoSelect 70.
Microrim	
BS3493/5	PersonalR:Base 99.
Microsoft	
BS3254	★ Excel for Windows 3.0 309.
BS2723/5	★ Office for Windows 649.
BS2733/5	★ Productivity Pack 42.

Okna Corporation	
BS3124	★ Desk Top Set 85.
Peachtree Software	
FN0233/5	Peachtree Complete III 5.0 145.
FN0253/5	Peachtree Cmpl. III Bonus Bdl 219.
Polaris	
BS2894	★ PackRat 3.0 259.
Precision Software	
BS1874	★ Superbase 4 Windows 419.
Prisma Software	
UT1044	★ Your Way 119.
Prodigy	
CM0264	Prodigy Startup Kit 29.
QMS	
BS1624	★ Ultrascript PC Plus 279.
Qualitas	
UT0683/5	386Max Professional 5.1 75.
Quarterdeck Office Sys.	
BS0163/5	DESQview 2.3 79.
BS1043/5	DESQview 386 2.3 135.
EX1103/5	★ QEMM 386 5.1 61.
Que Software	
WP0544	RightWriter 4.0 55.

Ethermate Trio16

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Reality Technologies	
FN0124	Wealthbuilder 1.1 139.
FN0334	WealthStarter 35.
Reference Software	
WP0334	Grammatik IV 2.0 57.
WP0514	★ Grammatik Windows 55.
Round Lake Publishing	
WP0523/5	Letterworks 59.
WP0573/5	Sales Letterworks 59.
Softlogic Solutions	
UT0073/5	Disk Optim. Tools w/ Data Guard. 39.
Software Directions	
UT1914	★ Print Q 5.0 85.
UT0884	PrintQ LAN 295.
Software Products International	
BS2863/5	★ Access SQL 949.
BS2873/5	Open Access 425.
Software Publishing	
WP0463/5	Professional Write 2.2 165.
WP1523/5	★ Professional Write Plus 169.
Software Ventures Corp.	
CM0314	★ MicroPhone II for Windows 229.
Spinnaker Software	
BS1923/5	BetterWorking Eight-In-One 35.
BS1134	The Resume Kit 29.
Stac Electronics	
EX1480	Stacker 99.
EX1490	Stacker Co-Processor 165.
Sybiz	
FN0314	Service Industry Accounting 295.
Symantec	
BS0653	Q&A 3.0 235.
UT1694	Norton AntiVirus 84.
UT0054	Norton Util. Advanced 5.0 115.
UT1604	The Norton Backup 1.2 95.
BS2113/5	Timeline 4.0 472.
Symantec/Hellix	
BN0024	Norton Util. w/ Netroom Bundle 134.
Teleware	
FN0414	★ M.Y.O.B. 149.
ThreadZ Software Design Group Inc.	
UT1804	★ ThreadZ File F/A 75.
Timeslips Corp.	
BS0133/5	Timeslips III 4.0 189.
Touchstone	
UT0734	Check It! 3.0 85.
Traveling Software	
UT0394	Laplink III 89.
UT2014	WinConnect 65.
Trend Micro Devices	
UT1964	PC-Cillin Virus Immune System 99.
Vertisoft	
UT0904	Double Disk 65.
WestCliff Software	
WP1503/5	DosAmigos 99.
WordPerfect Corp.	
WP0363/5	WordPerfect 5.1 249.
WP0504	LetterPerfect 139.
WordScience	
WP0483/5	Definitions Plus 69.
WordStar U.S.A.	
WP0634	WordStar Legacy 269.
XTree Company	
UT1874	XTree Gold 2.0 95.

LANGUAGES

Asymetrix	
LN1454	★ Toolbook 299.
Borland International	
LN1654	Borland C++ 2.0 Prof. 335.
LN0023/5	Turbo C++ 69.
Microsoft	
LN0074	C Compiler 6.0 319.
LN0043/5	QuickC 2.5 69.
Nantucket	
LN1444	Clipper 5.0 519.
Solution Systems	
LN0433/5	Brief 3.0 for DOS 179.
Spinnaker Software	
LN1464	★ Spinnaker Plus 279.



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BUILDING WORKGROUP SOLUTIONS

Unix Services for DOS-Based PCs

by Kaare Christian

The 1980s saw a steady rise in the ability of DOS-based PCs to deliver increased individual productivity. The large number of those PCs linked via networks indicates the growing importance of the connected workplace. The next major step for networking is to facilitate relationships between these DOS-based systems and other platforms, most notably Unix.

Connecting a network of DOS-based PCs and a Unix-based system is vital to organizations that rely on these diverse platforms. These six products help to accomplish that goal.

Closer links between the two systems are vital in many large organizations and corporate departments where Unix, thanks to its strong network facilities, has been a popular choice for workstations and servers. Engineering, scientific, vertical, and other applications benefit from Unix, and its use in these

environments is not likely to decrease. But many of these same organizations have also seen an increase in the number of DOS-based PCs in recent years and need a way to connect the two platforms.

CONNECTIVITY UNIX SERVICES

Forging a closer relationship between DOS networks and Unix-based systems by allowing them to share files is not a trivial task. Because DOS itself has done relatively little to facilitate networking, many companies have offered up their own network solutions. Lower-cost packages like Artisoft's *LANtastic* and D-Link's *LANsmart*, and higher-end products like Microsoft's *LAN Manager* and Novell's *NetWare 386* are only some of the popular systems in use. No single DOS-to-Unix solution can work with all DOS networks.

Unix, being a much more comprehensive operating system than DOS, further complicates the situation. Like OS/2, Unix offers multiple tasks (pseudosimultaneous activities), but unlike OS/2, it allows simultaneous multiple users. Unix is also a protected-mode operating system, which means that network capabilities are designed into the system rather than

sprinkled on top of it, as is the case with most DOS network products. These significant differences make it that much more challenging to develop a DOS-to-Unix network product.

Warp-speed file serving is not the Unix system's forte. Although it performs respectably, specific file-server solutions like Novell's *NetWare 386* are much faster. Unix is important for other reasons. If you already use expensive mainframe applications, they may downsize more easily to a departmental Unix system than a pure DOS network. If you're looking into delivering group productivity solutions, the multitasking and multiuser facilities of Unix may make your job easier.

SIFTING THROUGH JARGON

Although it is possible to connect a DOS-based PC to a Unix server and share files

using an RS-232 serial data line, local area networks provide a much faster, richer connection. But it's important to understand some of the network jargon, so you can make intelligent decisions about internetwork solutions.

The most basic elements of operating systems are their low-level protocols. These are important because they are the building blocks for important services like file sharing, printer sharing, e-mail, and groupware.

In DOS systems, the universal low-level protocol is NetBIOS, originally the protocol of IBM's early *PC Network*. SMB, the lingua franca of *LAN Manager*, was developed by Microsoft, IBM, and Intel to provide a speedy way to handle common tasks such as opening, reading, writing, and unlocking data files. Another important low-level protocol is IPX, developed by Novell for its network needs.

In the Unix world, the most important low-level protocols are IP, TCP, and UDP, which were originally developed to support what has become the Internet (a global network developed by the U.S. Department of Defense). The trio is usually referred to, somewhat loosely, as TCP/IP. Another important facility is NFS, a protocol for file sharing developed by Sun Microsystems.

REVIEW CRITERIA

In this review, we look at software that integrates DOS networks and Unix networks by providing the capability to share DOS files across platforms. The products we reviewed were *Atlantix Access*, Version 1.0; Hewlett Packard's *HP LAN Manager/X HP-UX*, Version 1.01; Sun Microsystems' *PC-NFS*, Version 1.01; Interactive Systems' *Ported NetWare*, Version 3.0; Performance Technology's *POWERfusion*, Version 1.3, with *POWERfusion Extras for DOS*; and AT&T's *Star-Group LAN Manager Server*, Version 3.4. The pricing structures for these products vary widely, from \$325 per workstation for *PC-NFS* to *Ported NetWare*'s \$4,995 price tag for an unlimited number of users.

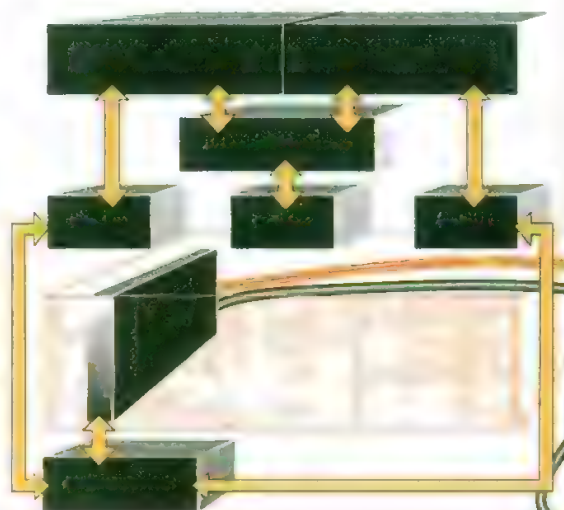
The portable versions of Microsoft's *LAN Manager* and Novell's *NetWare* either are or will be available from several licensed sources. In the U.S., Data General, Unisys, and NCR have signed up to license the AT&T version of *LAN Manager*.

MAKING SIMULTANEOUS CONNECTIONS

You can attach your DOS-based PCs to a Unix server and still use your old network. In the PC arena—where Novell's *NetWare* is undoubtedly the most popular network operating system—networked DOS users can connect with the Unix server in addition to the *NetWare* server. This diagram presents, in highly simplified format, the classic method of simultaneously connecting a DOS-based PC to both a Unix SMB server and a *NetWare* server.

Client PC with both SMB/NetBIOS and NetWare capabilities

The client PC illustrates the approach used in programs such as *Atlantix Access*, among others. A single multiplexing interface called a packet driver addresses specially configured IPX and NetBIOS network communications programs. These programs move data to and from their respective redirectors. IPX works with the *NetWare* shell and enables communication with the *NetWare* server, while NetBIOS provides the connection to the Unix server and works with SMB and its redirector, which is tightly integrated with DOS.





EDITORS' CHOICE

● *POWERfusion*, Version 1.3, with *POWERfusion Extras* for DOS

Organizations with networks of both DOS-based PCs and Unix systems have everything to gain from being able to share files between the two platforms, not least the ability to take advantage of Unix's special strengths, such as simultaneous multiple users and multiple tasks. When you're looking for a product to accomplish DOS-to-Unix communications, functionality is an even more important factor than speed. Unix's strong suit is not lightning-fast file serving, so it's no surprise that none of the six products we reviewed can compare to *Netware 386*, Version 3.1.

Performance Technology's *POWERfusion*, Version 1.3, and its companion product, *POWERfusion Extras* for DOS, offer the flexibility and features you need, plus good performance for this class of software. Together, the *POWERfusion* products provided scores on our benchmark tests that were considerably faster than most of their competitors.

While vendor pricing schemes vary widely for these products, no matter how you look at it, the

POWERfusion offerings are comfortably priced. At a total cost of \$6,000 for an unlimited number of users, the packages are not as inexpensive as AT&T's *StarGroup* (\$3,795 for an unlimited number of users), but compare favorably with *Atlantix Access*'s \$4,595 price for 32 users and the \$325-per-node price of *PC-NFS* (which can become costly for large installations).

The *POWERfusion* products' greatest benefits lie in their functionality and simple installation. Performance Technology offers versions of *POWERfusion* for several different flavors of Unix System V. The products also work with a nice selection of LAN adapters, and the company supplies a NetBIOS that works with packet drivers in the public domain. It also pays attention to details such as memory management—the DOS client systems require a mere 21K. The packages enhance their value by including the *Navigate* file- and directory-maintenance utility and providing *POWERfusion Extras*' peer-to-peer connections for DOS users.

There are reasons why some might opt for *Ported NetWare* over the *POWERfusion* products. They may be in an organization where many users and administrators are already trained in *NetWare*, or they may want to gain total insulation from Unix commands, particularly for printing. The *POWERfusion* family does not make the management of print jobs on the Unix machine totally invisible, although it's worth noting that *POWERfusion Extras* does allow any PC on the network to act as a print server.

People coming from Unix-rich organizations know and love NFS, which may arouse their interest in Sun Microsystems' *PC-NFS*. But the smaller RAM requirements of *POWERfusion* in the client PC, along with its other outstanding features, may overcome even a longstanding familiarity with NFS. Performance Technology offers an excellent package of flexible and high-performance products for anyone who wants to link DOS-based PCs to computers running Unix.



TCP/IP: A TECHNOLOGY PRIMER

Ideally, DOS users connecting to a Unix server in order to share its files will notice nothing different about their PCs beyond the additional drive letters that can appear as command line prompts. But behind that calm lies an array of processes by which two machines exchange the information that will ultimately provide the DOS user with the ability to download files from a Unix server and upload them to that server.

Together, these processes make up the TCP/IP model. The goal of the TCP/IP internetworking standard is to provide end-to-end connectivity between a number of different platforms. The IP (Internet Protocol) employs the Internet address, a 32-bit coding system that assigns a number to every node on the network. Besides identifying a node, the address provides a path that gateways can use to route

information from one machine to another. Internal look-up tables and software based on the ARP (Address Resolution Protocol)—an attribute of the IP program—help route data through a gateway between different TCP/IP networks. Working in conjunction with the IP address, the UDP (User Datagram Protocol) can be used to move information to the right application on the receiving system.

The TCP (Transmission Control Protocol) enters the picture when the packet has been delivered to the correct Internet address and application port. Software on each system adhering to the TCP standard establishes a connection and manages communications exchanges. In managing the data flow, TCP looks for responses and takes action to replace any missing data blocks.

The higher-level programs like **FTP** (File-Transfer Protocol), **NFS** (Network File System), and **SMTP** (Simple Mail-Transfer Protocol) rely on lower-level programs like TCP and IP to direct their instructions through the network. These protocols allow file transfers between DOS workstations and Unix machines. By executing the source code that makes up the TCP/IP model, some of the products we reviewed can implement communications between diverse platforms. (Not all the packages we examined use this model.)

All these programs rely on an electrical connection to enable connectivity—Ethernet or Token-Ring cabling, for example. This diagram depicts the ordering scheme of the layers and highlights actions particular to each layer.

to DOS immediately makes all Unix systems available, but Unix protocols are complex and can have a high impact on DOS workstation memory.

Atlantix Axxess, *HP LAN Manager*, *X HP-UX*, *Ported NetWare*, *POWERfusion*, and *StarGroup LAN Manager Server* are examples of the former approach; Sun's *PC-NFS*, and products like FTP Software's *PC/TCP*, Wollongong's *WIN/TCP*, and Clarkson University's *CU/TCP* (which are not as comprehensive as *PC/NFS*) are examples of the latter. A third approach is embodied in Locus's *PC Xight*, which uses its own protocols.

Users must also consider the network operating systems to which their DOS—and in some cases, OS/2—machines are already tied. Packages such as *Ported NetWare*, *Atlantix Axxess*, and *POWERfusion* work with the most popular network operating system, Novell's *NetWare*. *Axxess* brings not only *NetWare* but also *LAN Manager* and other PC network protocols to the Unix environment. And like most other companies that integrate DOS and Unix networks, Atlantix also includes a terminal emulation program that works over the network. *POWERfusion* and *POWERfusion Extras* work with various drivers that provide specific PC protocols, such as NetBIOS and SMB; a related product, *POWERbridge*, lets you use a PC to connect a pair of LANs.

Some users may prefer to continue to

run their current network operating system, but in a Unix version on a Unix box. This isn't possible with all of the popular PC networking systems, but it is for both *NetWare* and *LAN Manager*. Options like

Unix protocols are complex and can have a high impact on DOS workstation memory.

the AT&T, HP, and Interactive products are most appropriate when you want to run familiar DOS network standards but need the multitasking flexibility of a Unix host for added network functionality. Many people will find it easier to extend the functionality of their LAN using traditional Unix software development methods, rather than Novell's difficult NLM and VAP development facilities.

If you use Ultrix, DEC's implementation of Unix, the company now offers a version of Microsoft's *LAN Manager* that it calls *Pathworks for Ultrix* (see the sidebar "The DEC Connection: Linking DOS and OS/2 PCs to DEC's Ultrix"). The

product, which includes all of the basic capabilities of the AT&T and HP implementations of *LAN Manager*, should be available by the time you read this.

Sun's *PC-NFS* software allows DOS PCs to access files on any Unix host that supports NFS. *PC-NFS* also includes several specialized utilities. But what Sun really wants to peddle is its open network computing (ONC) environment. ONC includes capabilities that go beyond file sharing, such as remote procedure calls (RPC) and network information services (NIS). These facilities make it easier to write a truly networked application, in which parts of the application execute on your PC and other parts are transparently executed on a remote system. Sun also offers a programmer's toolkit, which helps developers create the DOS side of networked applications. (Utilities that come with Sun and other Unix-based systems take care of the Unix side.)

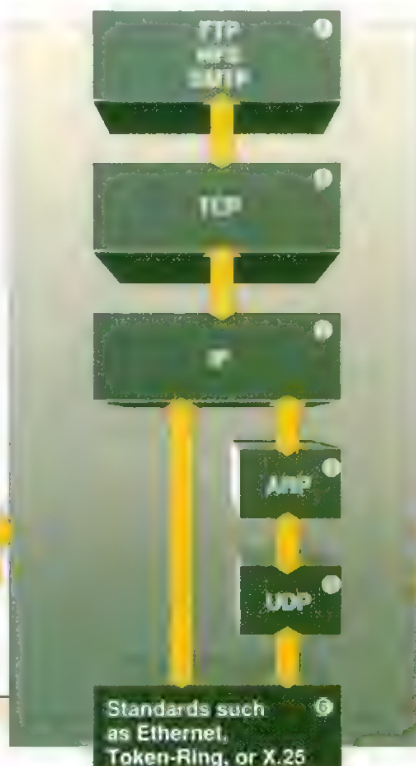
OTHER CAPABILITIES

In addition to supporting networked DOS and Unix file sharing, most of the products we reviewed also include other utilities. For example, many offer an over-the-wire (remote) log-on facility, which uses the network to log on to a multiuser host computer. This transforms your PC into a terminal, but lets you access the host using the high-speed network instead of a relatively low-speed serial-line modem.

THE TCP/IP MODEL

- ① Support for these programs means that the user on the DOS client station has a virtual connection to the Unix machine. When a user enters a command—for example, "COPY *.TXT F:", where F is the Unix host—the Unix machine carries out that request. The connection can also be made in the reverse direction.
- ② The products using this protocol establish the direct connection between the sender and the receiver (in the above scenario, between the DOS client machine and the Unix system).
- ③ This protocol clarifies each station's unique address so that the information will transfer properly.

DOS



- ④ This program, dependent on the IP program, can route data through a gateway between networks—for example, data coming from another Unix machine on another IP network.
- ⑤ Of the products we reviewed, only *PC-NFS* takes any notice of the IP/UDP layer, using it to provide the final routing of data within the receiving system.
- ⑥ Regardless of the operations performed, this layer remains constant with each network. It is the medium over which the electrical signal travels.

Unix



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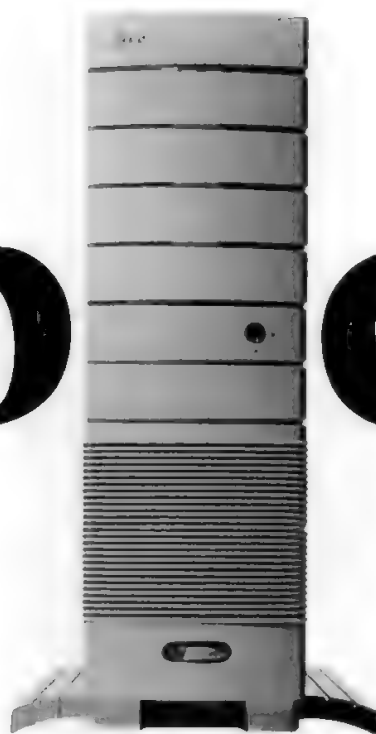
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System Features	AT&T StarServer S Model 3723-302	Compaq System Pro Model 400-420	AT&T StarServer E Model 3728-001
Processor Type	33 MHz Intel® 80486	33 MHz Intel® 80486	33 MHz Intel® 80486
CPUs (Standard/Max)	1/1	1/2	1/1
RAM (Standard/Max)	4 MB/64 MB	8 MB/256 MB	8 MB/512 MB
RAM Cache	128 KB	512 KB	256 KB per CPU
System Bus Speed	33 MB/sec	66 MB/sec	267 MB/sec
Int'l Storage (Std/Max)	300 MB/2.3 GB	420 MB/1.68 GB	300 MB/3.3 GB
Overall Storage (Max)	36 GB	19.88 GB	48 GB
Expansion Slots	10	11	12
Sold Through	Direct, Dealers	Dealers Only	Direct, Dealers
Manufacturer's Support Options	From 8-5 Weekdays to 24 Hrs. 7 days/week	From 7-7 Weekdays only	From 8-5 Weekdays to 24 Hrs. 7 days/week
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Computer Systems

USING THE INTERNET: Getting the Clarkson Packet Drivers

by Kaare Christian

A packet driver, the software interface between application software and network adapter hardware, handles the job of routing packets—or messages on the network—to the various applications registered with it. By allowing networked applications to talk to the packet driver instead of the network interface card, packet drivers lessen the programmer's problem of supporting multiple protocols and applications that need to share the same card simultaneously.

Clarkson University has become an important source of packet drivers. Following FTP Software's specifications, Russell Nelson of Clarkson created a skeletal packet driver. Based on his framework, many people around the country have created packet drivers for nearly every network board. These drivers give programmers an easy-to-use standard programming interface. The Clarkson collection of packet drivers lets programmers tailor the driver to fit the network adapter without starting from scratch.

One way to get the packet drivers from Clarkson is to download them from the Internet, a massive electronic network that connects computer networks across the country. If you don't have access to the Internet, you can dial into the Clarkson Heath User Group's BBS, or order the disks for a nominal charge from Russell Nelson himself.

To get a copy of the Clarkson driver library from the Internet, you must first find an Internet site. If you've never used the Internet, it would also be helpful to find an experienced Internet user. Many scientific agencies, U.S. government departments, universities, military branches, and large private corporations have members who dial into the Internet. Once you have found a site, use the *FTP* (File-Transfer Program) program, available on most Internet systems, to access the Internet site "sun.soe.clarkson.edu".

The Internet uses domain names, defining a domain as a group of other

domains or machines. Reading "sun.soe.clarkson.edu" from right to left, edu is the U.S. educational domain, which includes all educational institutions, clarkson is the domain for the whole of Clarkson University, soe is a subdomain at clarkson (for example, a departmental LAN), and sun is an individual machine in the soe domain. Respond to the log-on prompt with the name "anonymous" and supply your name when it asks for a "password."

Once you're on-line, move to the /pub/ka9q directory, set *FTP*'s file-transfer mode to binary, and then "get" the file "drivers.arc", which contains the Clarkson packet driver library. On your PC, you'll need to unarchive the file later to extract the individual drivers and documentation. Novell users should also get the file "novell.exe.uu" from the directory /pub/novell. You will need to decode it on a Unix system to extract its contents. The Novell file contains software that lets you adapt Novell's network drivers to make use of the Clarkson packet drivers.

To use the packet drivers you'll need some additional software from Clarkson, this time from the site "omnigate.clarkson.edu." One of the most useful programs is a version of *FTP* that runs on DOS systems. You can use *FTP* to transfer files between your PC and any other machine on the network that supports the *FTP* protocol. Another useful program in the Clarkson repertoire, *TelNet*, lets you use your PC as a terminal on a multi-user system and handles communications over the network. Other utilities allow your DOS system to print via the network on a Unix host's printer. ■

The Clarkson Packet Driver Collection

Russell Nelson, 11 Grant St.,
Potsdam, NY 13676. BBS: 315-268-6667.

List Price: \$23 for disks. Specify either executables only (drivers.arc), or source and executables (driversss.arc).

CIRCLE 423 ON READER SERVICE CARD

Most of the remote log-on programs emulate popular terminals, such as VT102 and ANSI, and many are based on the *TelNet* program and remote log-on protocols, which have been in widespread use for many years on multiuser systems.

Some of the reviewed packages also include versions of the *FTP* program, a standard facility for manual file-transfer systems that support the File Transfer Protocol (*FTP*). *FTP* is analogous to the file-transfer capabilities of a more familiar program such as Datastorm's *ProComm Plus*, but here again, the transport medium is the network. Like the *TelNet* protocol, *FTP* is one of the higher-level protocols that make up the TCP/IP internetwork standard for providing end-to-end connectivity for a number of different machines from different vendors. Other commonly supplied utilities include printing and e-mail facilities.

A NEW CONSCIOUSNESS

Running various network protocols such as IPX or SMB on a single wire isn't difficult. In fact, it's usually trivial, because transport hardware (Ethernet, for example) is designed to support multiple protocols. In DOS systems, the real difficulty is running multiple protocols and multiple network software products using a single network adapter. That's because most networking software for the DOS environment assumes that it "owns" the network adapter. However, the increasing emphasis on multiple protocols and connectivity to multiple hosts means that DOS networking software has had to become sensitive to adapter "sharing."

Adapter sharing was greatly facilitated by *FTP* Software, a company which created and publicized a packet-driver specification. A packet is a message on the network; a packet driver is a software interface between the application software and the network adapter hardware. When packet drivers are used, individual network applications talk to the packet driver instead of talking directly to the network adapter hardware. A network application (or TSR program) registers itself with the packet driver and tells the driver what types of packets it wants to handle. When a relevant packet arrives, the packet driver passes it on to the registered application. This relieves applications of the burden of supporting multiple adapters and lets several applications simultaneously use a single adapter.

Clarkson University is an important

source of packet drivers. Following FTP Software's specifications, Russell Nelson, software development engineer at Clarkson, created a sample packet driver for the 3C501 and NI5210 network boards and made them publicly available. Public-sprited programmers used Nelson's example to create packet drivers for other network boards. The result is a readily available library of packet drivers for 33 different PC network boards.

Clarkson's packet-driver library can be acquired via the Clarkson Heath User's Group's BBS (315-268-6667) or via the Internet, a worldwide network that links most major computing sites. (See the sidebar "Using the Internet: Getting the Clarkson Packet Drivers.")

ACHIEVING INTEROPERABILITY

In the peer-to-peer DOS-based network arena, D-Link's *LANsmart* has the architecture that is most adaptable to running multiple protocols. Since its inception, *LANsmart* has worked with FTP Software's *PC/TCP* package, and it is also compatible with the Wollongong and Clarkson utilities. Artisoft's *LANtastic* seems to have less inherent internetwork potential, but its large market share has created a market for compatible protocols, and it can be used with both FTP Software's and Wollongong's packages.

When you are looking for a product to connect your network of DOS-based PCs to a Unix system, functionality is a more important factor than speed. Our performance tests show that although the products we reviewed are usually fast enough to provide file services for dozens of connected PCs, none can compare to *NetWare 386*, Version 3.1. In fact, since it was impossible to hold the server and adapter hardware constant among the various products, the speed differences we saw should be viewed as gross comparisons. More important considerations for many users are the amount of RAM consumed by drivers and TSRs in DOS client machines, the product's printing and e-mail options, compatibility with network adapters, and compatibility with versions of Unix. You should also pay attention to vendor pricing strategies, which vary widely.

One thing that remains constant is that integrating diverse platforms can be a complicated process. Making products work with everything and on everything is an admirable goal, but not always painless to achieve.

Atlantix Axxess

by Paul Ferrill

While interoperability may sound like a marketing person's smoke screen, *Atlantix Axxess*, Version 1.0, from Atlantix Corp. could help define the true meaning of the word. In addition to running on Unix servers, *Axxess* is compatible with *NetWare* and *LAN Manager* servers, including those running the AT&T and Hewlett-Packard *LAN Manager* packages reviewed here. Client computers can run DOS, SCO Unix, Xenix, or OS/2. The \$4,595 price tag for a 32-user system makes it more expensive than the \$3,795 unlimited-user version of AT&T's *StarGroup LAN Manager Server*, Version 3.4, but the two products differ. *StarGroup* runs over AT&T Unix System V instead of SCO Unix. And unlike *StarGroup*, *Axxess* lets you attach a client PC to both Unix and *NetWare* servers simultaneously.

Axxess will interest any organization with SCO Unix machines and *NetWare*

servers in the same facility. The package currently supports Version 3.2.2 of SCO Unix but the company has plans to offer support for other versions of Unix in future releases. *Axxess* installs on both the client and server stations.

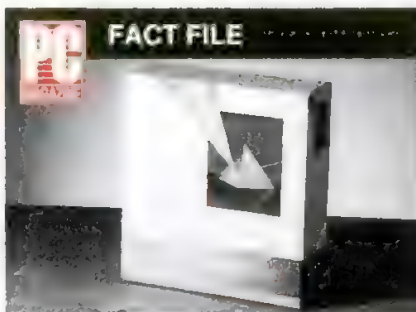
SERVER SIDE

Axxess contains several products in one package. On the Unix server, an extended Server Message Block (SMB) module provides file and print services to user workstations running DOS, OS/2, Unix, or Xenix. Below the SMB protocol, a piece of software called the Transport Layer Interface (TLI) supports multiple protocol stacks, allowing *Axxess* to address a NetBIOS layer in the Unix server. The NetBIOS layer is an implementation of the IBM NetBIOS Enhanced User Interface, commonly called NetBEUI. In the release of *Axxess* slated for mid-1991, Atlantix plans to provide the option of using a *NetWare* IPX protocol stack in the Unix server. This will give people with networks of both *NetWare* and SCO Unix computers yet another way to arrange their connectivity options.

Axxess also includes a piece of software that meets the ISO standard for a link-layer interface (LLI), allowing it to concurrently address multiple LAN adapters in the Unix server. This can provide performance advantages by splitting the client station load.

In theory, Atlantix's combination of SMB and NetBIOS allows the Unix server to work with client PC software marketed by other companies using SMB over NetBIOS, such as DCA's *10NET Plus*. But companies often use their own extensions and interpretations of both the SMB and NetBIOS standards. Believe in real interoperability between any of these products when you see it.

While *Axxess* over SCO Unix shares some of the design elements found in implementations of *LAN Manager*, it doesn't have all of *LAN Manager*'s administrative, trouble-shooting, security, and printing capabilities. Its strength lies in communicating across the network, with support for *LAN Manager* SMB facilities such as Named Pipes and Mail Slots for distributed applications. Programmers can use the Mail Slots as application program interfaces to create communications paths for applications. But since *Axxess* lacks *LAN Manager*'s administrative frills, you must do a lot of the administrative and security work in Unix.



Atlantix Axxess, Version 1.0

Atlantix Corp., 4800 N. Federal Hwy., #301-B, Boca Raton, FL 33431; 800-262-6526, 407-362-9700.

List Price: For 32 users, \$4,595.

Requires: For server: 386, 486, or RS6000 processor; 8MB RAM; SCO Unix, Version 3.2.2; StarLAN, Tiara, or Western Digital Ethernet card, or Racore Token-Ring card. For client: 67K RAM; DOS 3.2 or later, OS/2 Extended Edition 1.2, or SCO Unix; Gateway, Novell, Racal InterLan, 3Com, Tiara, or Western Digital Ethernet card, or IBM or Racore Token-Ring card.

In Short: *Atlantix Axxess* provides true interoperability, allowing you to connect multiple LANs to a SCO Unix box and make them all communicate, but its price may discourage the small shop looking for a way to connect a limited number of machines. The package is particularly valuable for its ability to connect *NetWare* and *LAN Manager* networks, albeit slowly. An interesting optional program provides simultaneous access to multiple Unix and DOS sessions under Microsoft Windows 3.0.

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UNIX SERVICES FOR DOS-BASED PCs: SUMMARY OF FEATURES

List price In most cases, we provide a list price for an unlimited number of users; when that is not possible because of the company's pricing scheme, we note the number of users to which the price applies. For *HPLAN Manager/X HP-UX*, the \$2,000 price of the eight-user version refers to the software for HP's non-Intel-based servers; the \$3,995 refers to the unlimited-user version available for its Intel-based machines. Except where noted, the list price includes both the server and DOS client software.

RAM required in server is the minimum amount of memory the server requires for both Unix and the server software.

RAM required in client PC is the amount of memory a DOS client PC requires without the use of high, extended, or expanded memory drivers.

Client software provides high-DOS drivers indicates whether the software includes drivers for memory above 640K. All of these products can work with third-party memory-management software.

Using more than one adapter in the server can often usefully split the load on the cable and adapters.

Maximum number of network adapters shows the most the software will allow. The hardware limitations of your server will often limit the number of adapters you can install.

Remote boot support tells whether the server software can remotely boot networked DOS PCs.

If a program **coexists with NetWare**, the redirector and drivers provided to make the PC a client of the Unix file server can work with Novell's *NetWare*.

With **workstation printer sharing**, individual client PCs can make their attached printers available to the rest of the network.

A program that **shows current view of activity** displays information such as the number of packets moving across the network and the number of files in use.

Sets archive file attributes If the file-server software does not set the DOS archive file attributes, it is difficult to back up files on the DOS clients.

Aids PostScript printing tells whether the program includes utilities that provide the proper preamble to aid PostScript print jobs sent by client PCs.

If **end users can control print queue**, they need not enter the Unix print utilities.

Software with **group access** makes resources available based on membership in a particular group.

Software with **resource passwords** control lets you access by associating a password with each resource.

FTP, SMTP, TelNet, VT220 terminal emulation The File-Transfer Protocol (FTP), Simple Mail-Transfer Protocol (SMTP), and TelNet terminal emulation protocol, along with DEC VT220 terminal emulation, are all part of the TCP/IP software suite and provide another means of moving files between dissimilar computers.

	Atlantix Access	HP LAN Manager/X HP-UX	Ported NetWare	POWERfusion with POWERfusion Extras for DOS	PC-NFS	StarGroup LAN Manager Server
List price	\$4,595 (32 users)	\$2,000 (eight users), \$3,995 (unlimited users)	\$4,995	\$6,000	\$325 per DOS client node (includes no server software)	\$3,795
OS/2 client software included	■	■	■ (on request)	□	□	■
MEMORY USAGE						
RAM required in server	8MB	4MB	4MB	4MB	4MB	5MB
RAM required in client PC	67K	128K	70K	21K	80K	135K
Client PC software includes high-DOS drivers	□	■	■	■	□	■
SERVER SOFTWARE SUPPORT						
Maximum simultaneous clients	32	255	Unlimited	500	Unlimited	1,000
Maximum number of network adapters	Unlimited	Unlimited	1	2	Unlimited	4
Remote boot support	□	□	■	■	□	■
CLIENT-PC SOFTWARE SUPPORT						
Coexists with <i>NetWare</i>	■	□	■	■	□	□
Workstation printer sharing	■	□	□	■	■	■
SERVER ADMINISTRATION						
Shows logged-on users	■	■	■	■	■	■
Maintains historical log	■	■	■	■	■	■
Shows current view of activity	■	■	■	■	□	■
Sets archive file attributes	□	□	■	□	■	■
PRINTING						
Aids PostScript printing	□	□	□	□	■	■
End users can control print queue	□	□	■	□	□	■
SECURITY						
Group access	■	□	■	■	■	■
Resource passwords	■	■	■	■	■	■
TCP/IP UTILITIES						
FTP	□	□	□	□	■	□
SMTP	□	□	□	□	■	□
TelNet	□	□	□	□	■	□
VT220 terminal emulation	□	□	□	■	■	□

■—Editors' Choice ■—Yes □—No

CONNECTIVITY UNIX SERVICES

For example, you have to use the *MS-Net*-style NET SHARE commands that are part of SMB to configure the network and employ Unix's LP Spooler capabilities to manage the print queue.

The server can run the Racore M8110 Token-Ring, StarLAN WD8003S, Tiara LE 16 Ethernet, Western Digital Ethernet WD8003E, or Western Digital Twisted-Pair Ethernet WD800WT card.

CLIENT SIDE

On the client side, users see servers as separate drive letters. *Acess* employs the NET USE and other standard Microsoft *MS-Net* commands to designate resources for file sharing on the server, mapping specific directories on the Unix machine to logical drives on the client PC. Since the *Acess* software consists mainly of redirectors and protocol stacks, the added drive letters that appear as prompts are the closest thing the program has to a user interface.

The special Novell IPX program supplied by Atlantix for the client (not to be confused with the future IPX option for the server mentioned above) works along-

side of its NetBIOS to address the client's adapter card in an orderly manner, moving packets from the adapter to either the IPX or NetBIOS without creating any conflict or confusion. The program then sends packets to the Novell server using IPX. You can use either version of the *NetWare* Shell, NET3 or NET4, with the Atlantix software to redirect requests from application programs to the network server.

A packet driver standard put into the public domain by Clarkson University and based on FTP Software's original specifications makes the integration between *NetWare* and SMB over NetBIOS possible. The packet driver provides a simple, common programming interface, allowing programs like the NetBIOS and IPX provided by Atlantix to share a network interface at the data-link level. It multiplexes and demultiplexes packets and routes them to the appropriate redirector in the PC.

Depending on whether you configure the client PC with or without Novell net-

work support, you'll wind up with 100K or 67K less memory, respectively, for DOS applications. All but about 5K of this usage can be moved out of the lower 640K of DOS memory with a product like *QEMM-386*, but Atlantix does not provide any utilities to perform this function.

Interface cards supported on the client PC include the Racal InterLan NI5010 or NI5210, Novell NE1000, 3Com 3C501 or 3C503, and the Western Digital WD8003 series. The software cannot use the NDIS interface to work with adapters.

SECURITY AND ADMINISTRATION

The Unix operating system provides users with the benefit of its inherent security features. Individual files have codes that explicitly grant permission for access only to those users with the proper rights. These rights permit all users, a certain group of users, or only the owner to access the file. In addition, each file has a read, write, and execute access code associated with it. Unix's default protection setup at log-on time allows all files created by a client to assume the same protection.

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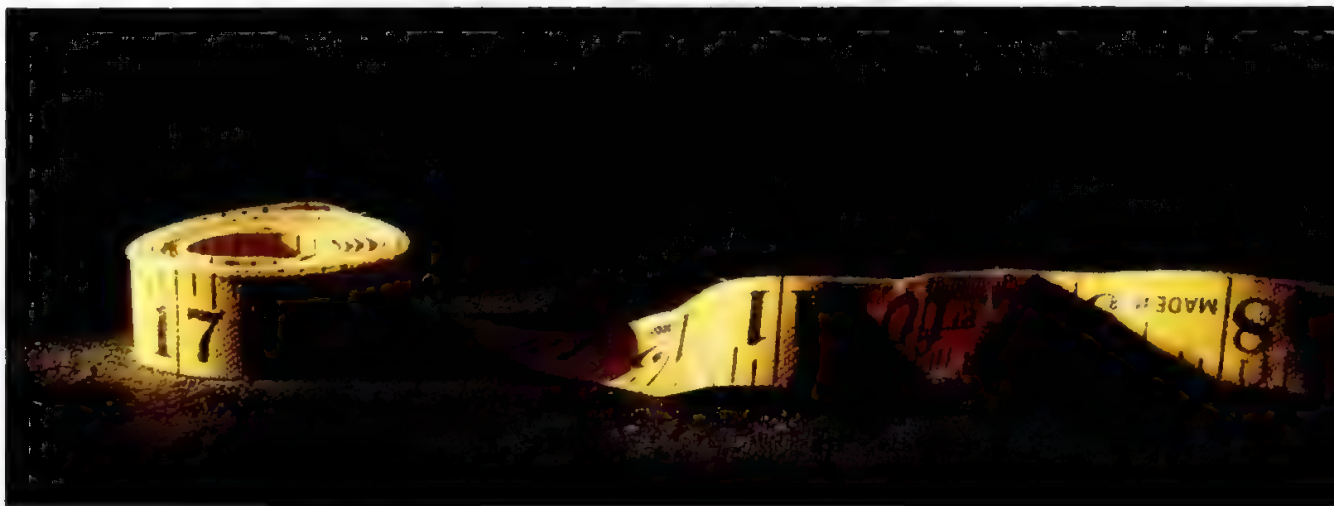
Weighing in at a slight three ounces, the Pocket Edition 2400 comes with everything you need to take it on the road—a 9-pin connector, cables, a handy carrying case, and our simple-to-use Hayes Smartcom EZ communications software.

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The Pocket Edition is incredibly compact, yet it contains many of the features you expect from our "full-size" Hayes modems. It's ideal for working remotely with your

Once again, Hayes has set modems will



CONNECTIVITY

UNIX SERVICES

Atlantix's simple terminal emulator package, *AxTerm*, gives DOS and OS/2 stations access to the Unix operating system. Using *AxTerm*, the system administrator can log into the Unix system and perform regular system-administration functions from a client machine, or access the SCO Unix SysAdmin facility and its menu-driven interface with all housekeeping functions, such as backups. It also gives all users access to the Unix mail program.

Atlantix offers an optional \$195 program, *WindowView*. This product supports simultaneous access to multiple Unix terminal sessions under *Microsoft Windows 3.0*.

EASY INSTALLATION, BUT ONE QUIRK

Easy installation on both the server and the workstation turns a potentially frustrating experience into a pleasant one, but we did find one quirk. The installation program asks you a series of questions and offers to relink the program after each question is answered. You're better off choosing to relink at the end of the installation. If you delete the network

scripts you know you won't need—for example, you probably won't want Ethernet, ARCnet, and Token-Ring scripts on the same network—you can avoid some of the tedious questions. Unfortunately, the program doesn't tell you that you can skip questions, and makes it seem as if you must relink each time.

The host software installation requires the Unix system administrator to log on using maintenance mode. No other users can access the system during this time. Installation on the client workstation takes about five minutes. The install program creates a new AUTOEXEC.BAT file on the client and renames the old one as AUTOUSER.BAT. Upon execution, the new AUTOEXEC.BAT links to the renamed AUTOUSER.BAT in order to execute any specific client instructions. It also slightly modifies the CONFIG.SYS file, specifying the LASTDRIVE and FCBS parameters.

On our benchmark tests, *Axcess* did not start off with the best scores, and as network traffic increased, its perform-

ance decreased further. In fact, *Axcess* was one of the slower products we tested for this review.

In case you need help, Atlantix provides free 90-day telephone support at a toll-free number with each copy of *Axcess*. After 90 days, you can arrange a support contract. One point in *Axcess*'s favor is that Atlantix has a strong base of experience and a good relationship with SCO. The company has been marketing server products for SCO Xenix and Unix for several years, and still sells an older product called *CocoNet* for connecting a SCO Xenix server to a Novell network.

While the \$4,595 price tag doesn't make *Atlantix Axcess* a price bargain, it could be worth its weight in gold to managers with SCO Unix computers they want to link to a network of PCs, particularly a *NetWare* network. *Axcess* can't hold a candle to *NetWare*'s throughput or management features, but it does offer true interoperability, a feature that might make the hefty price tag acceptable for some users. If your situation requires multiple access to dissimilar LANs, *Axcess* can provide a solution.

company's computer system. It keeps you in touch with electronic mail. You can even use it to deliver a FAX with an on-line service.

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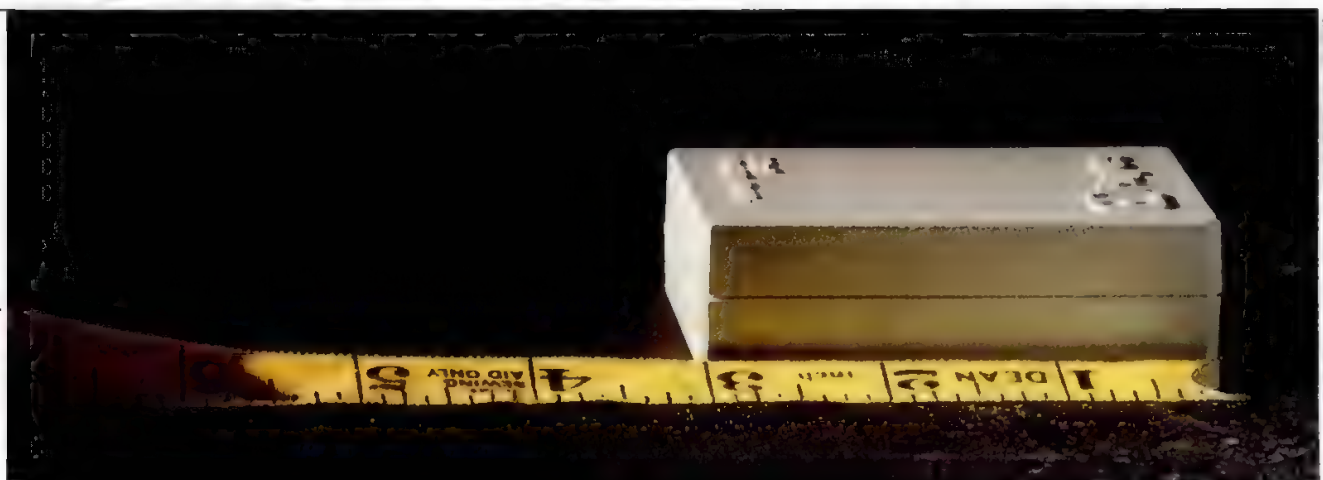
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HP LAN Manager/X HP-UX

StarGroup LAN Manager Server

by M. Keith Thompson

Both AT&T and Hewlett-Packard have rewritten Microsoft's OS/2 version of *LAN Manager*, Version 1.0, to run under their respective versions of Unix. AT&T's *StarGroup LAN Manager Server*, Version 3.4, and HP's *LAN Manager/X HP-UX*, Version 1.01, provide *LAN Manager* functionality, complete with Named Pipes for allowing applications to use comput-

**AT&T and HP have
rewritten the OS/2
version of *LAN Manager*
to run under Unix.**

ing resources transparently in other workstations or servers on the network, and Mail Slot application programming interfaces (APIs).

Because there are more similarities than differences between the products from AT&T and HP, we treat both versions in this review. The most important common feature to both products is, of course, their use of the *LAN Manager* network operating system. Microsoft's *LAN Manager* describes how a client process and a server process communicate. It uses the Server Message Block (SMB) protocol to provide file and print services with the server's resources for client processes, and a rich set of APIs to support distributed applications and network administration.

The two products have different pricing schemes. If you already own a Unix license from AT&T (these can cost anywhere from \$1,000 to \$50,000, depending on factors like the processor in the server and the number of users), the unlimited-user version of *StarGroup* is a good value. At \$3,795, it compares favorably to the \$6,490 price of Microsoft's *LAN Manager* for 1,000 users plus the server code, and the \$7,995 cost for the 250-user version of Novell's *NetWare 386*, Version

3.1. AT&T also offers an entry-level \$2,595 *StarGroup* package that includes a two-user Unix server and eight-user *LAN Manager* Server client license, and *PMX/StarMail*, an e-mail package. *StarGroup* is based on AT&T's Unix System V, Version 4.0, a version that unifies the major derivatives of Unix. It has features from Sun, Xenix, and the Berkeley version.

HP's *LAN Manager/X HP-UX* runs under HP's versions of Unix, HP-UX and HPSCO (despite the inclusion of the HP-UX operating system as part of its name, it can also run on AT&T's Unix System V and SCO). HP's pricing scheme is a little complicated, since prices vary based on the server the system uses. HP licenses a \$1,695, five-user version of *LAN Manager/X* to run on its Intel-based computers, such as the Vectra systems. An unlimited-user version of HP's *LAN Manager* for HP's Intel-based machines sells for \$3,995. Since its Intel-based machines don't come with Unix installed, you'll have to buy HPSCO Unix for \$895. The HP Apollo 9000 series computers (including the Motorola 68040-based 400 with which we tested the software) come standard with a two-user version of HP-UX. The cost for an eight-user version of *LAN Manager/X* running on one of these non-Intel-based systems is \$2,000. HP does not sell an unlimited-user version of *LAN Manager/X* for use on these systems, although you can buy versions that support up to 512 users.

SOME HISTORY

There has been some confusion over the origin of the versions of *LAN Manager* for Unix. In January 1988, Microsoft chose HP to codevelop a version of *LAN Manager* for Unix, designed around the OS/2-based *LAN Manager*, Version 1.0. The agreement allows HP to sell its Unix version of *LAN Manager* to its customers for use on its HP Server computers (both Intel- and Motorola-based), and for Microsoft to sell it to its customers running Xenix (Microsoft's version of Unix), as well as license it to third parties. In that same month, AT&T also elected to license Microsoft's *LAN Manager* technology and source code and write a Unix version of its own from the ground up. In February 1989, HP and AT&T began shipping their respective versions of *LAN Manager* for Unix.

Since then, six companies have signed

up to license *LAN Manager* over Unix from AT&T. These companies include the U.S.-based Data General, Unisys, and NCR, and the Europe-based Dansk Data, Elektronik, ICL, and Olivetti.

UP AND RUNNING

Both AT&T and HP provide good documentation, complete with screen shots and examples, for installing and using their versions of *LAN Manager* over Unix. The *StarGroup* documentation has one major omission, however. You must reference your server name with a ".serve" extension—the server software simply doesn't work without it—but the manuals do not mention this fact anywhere. It took a call to AT&T's technical support to solve this frustrating problem.

Otherwise, installing the server program is straightforward with either product. You simply use the Unix "installpkg" command and feed in the disks.

To run the server program on AT&T's multiprocessor *StarServer E* computer or 3B2s, you must install the *StarGroup LAN*



HP LAN Manager/X HP-UX, Version 1.01
Hewlett-Packard Co., HP Enquiries, 19310
Pruneridge Ave., Cupertino, CA 95014; 800-
752-0900.

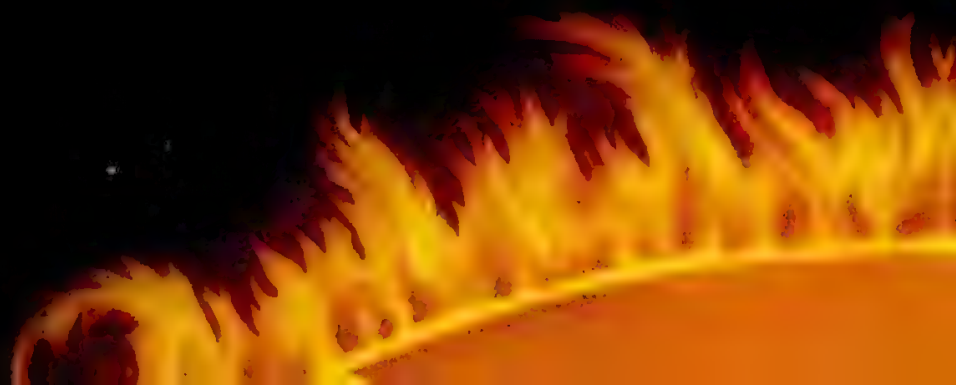
List Price: For eight users with Motorola-based server, \$2,000; for five users with HP Intel-based server, \$1,695; for unlimited users with HP Intel-based server, \$3,995.

Requires: For server: HP Series 9000 (300, 400, 600, or 800) with HP-UX, or HP Intel-based system with SCO, HPSCO, or Unix System V/386 3.2.2; 4MB RAM; HP Ethernet card. For client: 128K RAM, DOS 3.0 or later, OS/2 1.1, HP Ethernet or IBM Token-Ring card.

In Short: *LAN Manager/X* is a good Unix implementation of the original *LAN Manager*, although not the best. Well-documented, it provides interoperability through the Named Pipes and Mail Slots APIs. Available only from HP for HP computers, *LAN Manager/X* lacks the robust features of today's dedicated network operating systems, which limits its usefulness. It did provide top-flight speed—when paired with a 50-MHz Apollo system for our performance tests, its only competitor was Novell's *NetWare*, Version 3.1.

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THE X WINDOW SYSTEM: A Universal Graphical Interface

by Kaare Christian

No longer the signature of the illiterate, X now marks the signature of workstation computing. The X Window system supplies a portable, flexible, low-level graphical environment. Developed at MIT with strong backing from Digital Equipment Corp., X provides a universal foundation for graphical computing. This lofty but solidly attained goal gives X a different view from more-familiar graphical environments, such as *Microsoft Windows 3.0* or *GeoWorks' PC/GEOS*.

Although MIT and DEC originated X, control passed in 1988 to a vendor organization called the X Consortium. The Consortium is responsible for disseminating information about X, and for shepherding and extending the standard. At the time of this writing, X is in the fourth release of Version 11, often called X11, or more precisely X11R4 or X11.4. Many systems offer ready-to-run versions of X, including several for the PC. Although it's not yet shipping, the most publicized X server for the PC is *DESQview/X* from Quarterdeck Software. Locus has developed a product called *PC Xight* (\$425; \$495 with Lotus TCP/IP). You can also get massive source code versions of X, but they remain primarily of interest to experts, or to companies interested in adapting X to their hardware.

For many people, the first clue that X isn't just another knockoff of the ideas started at Xerox and commercialized with the Macintosh is that it doesn't include a user interface. No menus, no icons, no trash cans. Instead, X provides a foundation upon which user interfaces can be developed. Several interfaces have been built on top of X, including Motif, which gives X the look and feel of Presentation Manager.

A second surprise for many is that X is based on client/server technology. The X server responds to graphical requests, while the X client is the applications program that makes the requests. Both client and server can run

on a single workstation, or the server can run on one system and the client on another, communicating via the network. For example, a supercomputer X client running a weather simulation program can display results interactively on any PC running an X server.

WINDOWS COEXISTENCE

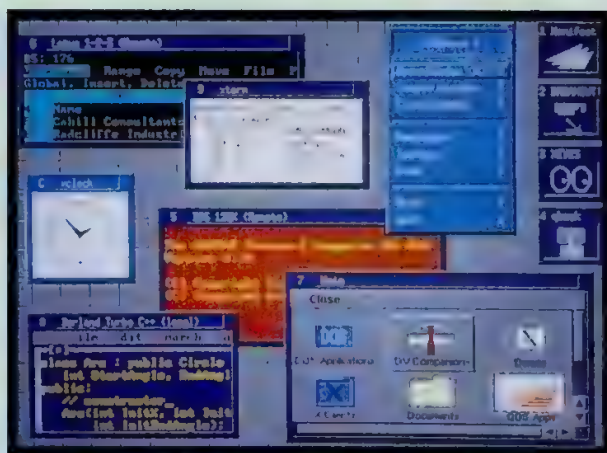
The X Window system is willing and able to coexist with other windowing systems. For example, X Window servers are available to work with *Microsoft Windows 3.0*. To *Windows*, the X Window server looks like a *Windows* application. To the X server, *Windows* looks like just an able graphical I/O system. Nobody expects a winner-take-all battle between *Windows* and X; we'll see both on many PCs.

The system's developers designed X to be extendable and developed a standard framework for expansion. Programmers are currently developing extensions for three-dimensional graphics, sound, and video. As these efforts mature, the X Consortium will consider them for incorporation into the X standard.

SQL RESEMBLANCE

Readers might see a similarity between X's low-level, network-oriented approach to graphical computing and the approach to database management of a structured query language (SQL). Both systems, powerful but user-hostile, need ancillary software to customize them for widespread use. The two systems sit on top of operating and computer systems, providing a system- and machine-independent means of attaining their goals.

Yet another similarity between X and SQL is how they can extend, via a network, the reach of PCs. Application



X Window provides a universal foundation for graphical computing. Quarterdeck's *DESQview/X* will be one of the packages offering a version of X ready to run on the PC.

downsizing is practical only if there are clear, powerful means of using the network for more than file-sharing. SQL answers the question "How do all those PCs access corporate data?" while X answers the questions "How do we write graphical software that runs on all our systems?" and "How do all those PCs access corporate computational resources, like other PCs, superminis, mainframes, and supercomputers?"

Acceptance of X on Unix workstations has already reached a critical mass. Most workstation manufacturers directly support it, and it's available in some form for virtually every workstation. Many X applications are available, and more are being developed, although by DOS standards the pickings look slim. While these packages assume critical importance for Unix users, they have less interest to DOS users, because the DOS marketplace already offers most of their functionality. X will become important in the DOS world by providing the graphical glue for downsized corporate applications, vertical multiuser applications, and other specialty software.

Any company developing software for all the graphical platforms—*Windows*, PM, Mac, and Unix workstations—should be very interested in X. It's the only way to write distributed graphical applications, and it's the only graphical language spoken everywhere. ■



BENCHMARK TESTS: UNIX SERVICES FOR DOS-BASED PCs

These products offer less than half the throughput of **NetWare 386, Version 3.1**. But depending on the workload and the Unix applications running at the same time, they are fast enough to provide file services for dozens of connected PCs.

The **Hard Disk Access Load** test reads random blocks of data from a 10K file on the server in 1K increments. The results of this test are reported in reads per second for all the PCs running the load test. The test begins and ends at the same time as the Workstation Throughput test.

The **Directory Access Load** test makes the server repeatedly search for a nonexistent file. Since the

file allocation table in most network servers is typically cached, this request causes a fast read to the cache. The repeated retries created by the client PCs generate a heavy load on the server's CPU. This test provides a general-purpose method of loading the server's CPU in the fashion of a resident task, such as a network-monitor program or a communications program. The results for this test are reported in transactions per second for all the PCs running the load test. The test begins and ends at the same time as the Workstation Throughput test.

The **Workstation Throughput** test reports the throughput recorded on a single PC during the performance of a standardized task on the network and is run in conjunction with either the Hard Disk Access Load test or the Directory Access Load test. The test program performs a sequential read, a random read, a sequential write, and a random write using a 1MB file. The record size systematically rotates among 16K, 4K, and 512 bytes. The throughput is reported in megabits per second.

HOW WE TESTED

The testbed consisted of a variety of 286- and 386-based computers acting as load stations and a single ALR FlexNode equipped with a 20-MHz 386 processor as the single-node performance PC. The Workstation Throughput test was run separately on the ALR: We synchronized that station with the activity of up to four other stations running either the Hard Disk Access Load test or the Directory Access Load test in order to measure how much work the load stations do during the test, as well as the throughput of the single-node performance PC.

The numbers resulting from both throughput tests are graphed side by side with the results of their respective access load tests. In this way, the relationship

SYSTEM LOAD TESTS

(Higher scores represent better performance)

HARD DISK ACCESS LOAD (reads per second)

	No load *	One station	Two stations	Three stations	Four stations
NetWare 386		164.28	328.13	428.49	497.56
HP LAN Manager/X HP-UX		47.08	100.27	129.89	164.39
POWERfusion with POWERfusion Extras for DOS		61.67	142.48	229.24	216.90
Ported NetWare		44.71	70.41	83.59	92.06
StarGroup LAN Manager Server		45.00	71.21	140.23	138.20
Alantix Access		58.55	126.34	181.51	166.40
PC-NFS		53.20	89.55	68.84	72.67

DIRECTORY ACCESS LOAD (transactions per second)

	No load *	One station	Two stations	Three stations	Four stations
NetWare 386		961.56	1,448.83	1,585.08	1,157.24
HP LAN Manager/X HP-UX		92.11	406.26	418.02	340.61
POWERfusion with POWERfusion Extras for DOS		106.25	791.66	636.89	485.08
Ported NetWare		110.00	97.90	78.76	55.50
StarGroup LAN Manager Server		108.00	96.20	77.75	54.20
Alantix Access		395.65	488.17	416.30	280.13
PC-NFS		268.35	262.30	114.33	97.60

* Not applicable.

Manager Multiprocessor Activator after you install the server program. HP can run **LAN Manager/X** on its multiprocessor 9000 series computers without any additional steps.

While **LAN Manager/X** uses the less-common share-level security as the default, **StarGroup** uses the **NetWare** and **Microsoft** user-level security default. Share-level security requires users to supply a password for each network resource they want to use. **StarGroup's** user-

level security scheme uses a password for each user, letting the network operating system handle the resources the user can access. While you can configure your server to use either type of security, only one type of security can be used for each server on the network. Both **StarGroup** and **LAN Manager/X** allow the standard security features—read only; read and write; read, write, and create; and read, write, create, and delete permissions, right down to the file level.

Installing the client software is also simple. The install programs are menu-driven and provide easy-to-follow on-screen prompts that ask permission before modifying your **CONFIG.SYS** and **AUTOEXEC.BAT** files. Neither company allows you to unload the network drivers or programs to free up memory when the network is not needed.

AT&T provides a nice extra with a program on the client PC that prompts you at boot time to see if you want to load the

between the throughput experienced by the PC running the throughput tests and the stations running the load tests is clear, as is the overall work done by the network.

CHOICE OF SERVERS

The architecture of some of these products made it impossible to test all the software on the same server. When we could—with *Atlantix Axxess*, *PC-NFS*, *Ported NetWare*, and the *POWERfusion* products—we used a Dell System 433E equipped with an 80486 processor running at 33 MHz and equipped with 16MB of RAM. This level of machine is appropriate in price and performance for a Unix server.

For compatibility with *HP LAN Manager/X HP-UX*, Hewlett-Packard provided us with its Apollo Series 400 computer, which uses a 50-MHz Motorola 68040 processor

running 8MB of RAM. AT&T sent its 6386 E/WGS, which uses a 33-MHz 80386 processor and 16MB of RAM for use with *StarGroup LAN Manager Server*.

We include benchmark test scores for a server running *NetWare 386*, Version 3.1, for comparison. We used the same Dell server that was used to test the other products.

ADAPTERS AND MEDIA

Generally, we used Western Digital WD8003 8-bit Ethernet adapters in the client PCs and WD8013EBT 16-bit Ethernet adapters in the Dell server. But *Atlantix Axxess* required the use of a 16-bit Tiara LanCard/E*AT adapter in the server, AT&T supplied its own 16-bit 10BaseT adapter, and the HP Apollo has its own internal adapter. We ran the tests for

AT&T's product over 10BaseT wiring; all other tests used thin Ethernet coaxial cable.

We tested *Atlantix Axxess* and the *POWERfusion* products over the same copy of SCO Unix, Release 3.2, Version 2.0s. For the tests on *PC-NFS*, the Dell used an implementation of NFS provided by Interactive Systems. The other companies provided their own Unix operating systems; we used Interactive's Unix, Version 2.2, with its product, HP-UX with HP's product, and AT&T's Unix System V, Release 4, with its software.

The PC Magazine LAN Labs benchmark tests are written in C and are independent of commercial software. Each load station operates at a rate many times that of a PC, even one in a heavy-use environment.

SINGLE-NODE THROUGHPUT TESTS

(Higher scores represent better performance)

WORKSTATION THROUGHPUT (a) (megabits per second)

	No load	One station	Two stations	Three stations	Four stations
NetWare 386	2.92	2.73	2.41	2.18	1.79
HP LAN Manager/X HP-UX	1.33	1.23	1.15	1.03	0.94
POWERfusion with POWERfusion Extras for DOS	1.28	1.19	1.05	0.92	0.81
Ported NetWare	1.16	0.78	0.50	0.36	0.28
StarGroup LAN Manager Server	1.15	0.72	0.48	0.33	0.28
Atlantix Axxess	0.86	0.71	0.50	0.38	0.36
PC-NFS	0.56	0.45	0.35	0.26	0.20

WORKSTATION THROUGHPUT (b) (megabits per second)

	No load	One station	Two stations	Three stations	Four stations
NetWare 386	2.92	2.91	2.79	2.82	2.71
HP LAN Manager/X HP-UX	1.33	1.26	1.20	1.01	0.99
POWERfusion with POWERfusion Extras for DOS	1.28	1.20	1.07	0.95	0.86
Ported NetWare	1.16	0.32	0.17	0.12	0.09
StarGroup LAN Manager Server	1.15	0.30	0.16	0.10	0.10
Atlantix Axxess	0.86	0.71	0.48	0.37	0.33
PC-NFS	0.56	0.50	0.41	0.31	0.21

(a) With Hard Disk Access Load running.

(b) With Directory Access Load running.

CONTINUES

network software. This program runs from the CONFIG.SYS file and keeps the network drivers from loading and taking up memory when you don't intend to use the network.

To maximize their connectivity options, both AT&T and HP support all models of their own network cards, as well as network adapters with NDIS drivers, on both the clients and server. Network driver memory consumption is kept to a minimum by using expanded or ex-

tended memory.

AT&T doesn't support diskless workstations very well, and HP doesn't support them at all. AT&T allows diskless booting only with an additional boot card in each workstation. The traditional way of adding a boot ROM to the network card itself is preferable.

SYSTEM DESIGN

HP designed *LAN Manager/X* to use one Unix process per *LAN Manager* user; this

is similar to the way Unix handles standard Unix users through terminals. Contrary to HP's belief, AT&T believes this creates too much overhead for the server. AT&T uses an intelligent algorithm instead, based on the amount of work load on the server, to allow one Unix process to handle multiple users.

In *StarGroup*, the redirector sits atop an ISO protocol stack providing a Net-BIOS interface. The server program also sits atop an ISO protocol stack, which



COMPOSITE VIEW: UNIX SERVICES FOR DOS-BASED PCs

The results we obtained using *NetWare 386*, Version 3.1, make one thing clear: *NetWare's* specialized packet protocol and file-handling design will be difficult to beat.

The power of a 50-MHz CPU, customized software, and a tightly integrated

network adapter gave the HP system an edge over all of its Unix competitors, particularly when the server's CPU was busy with the Directory Access Load test. The PC running the Workstation Throughput test was able to continue to move data

at a megabit per second to the server, even when its CPU was supposed to be busy elsewhere.

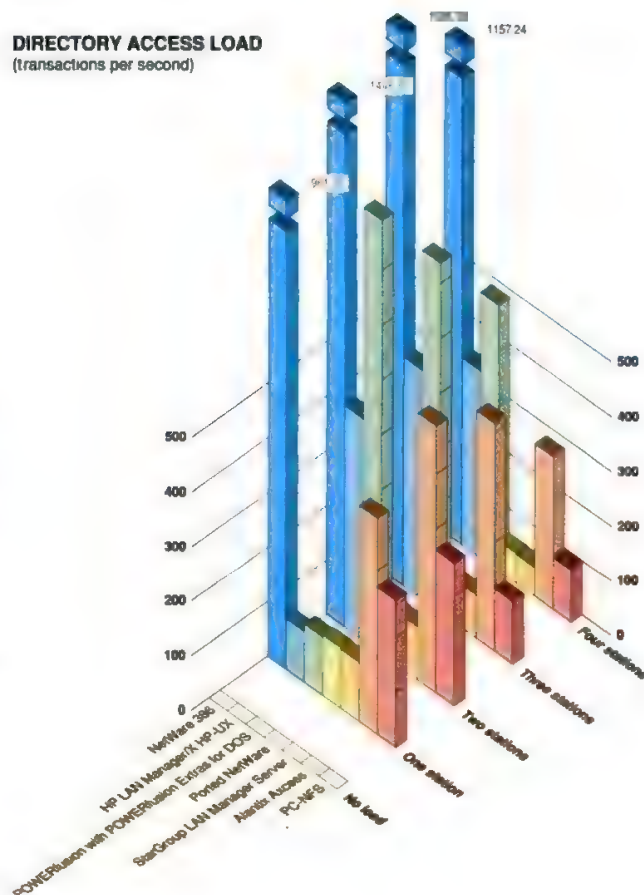
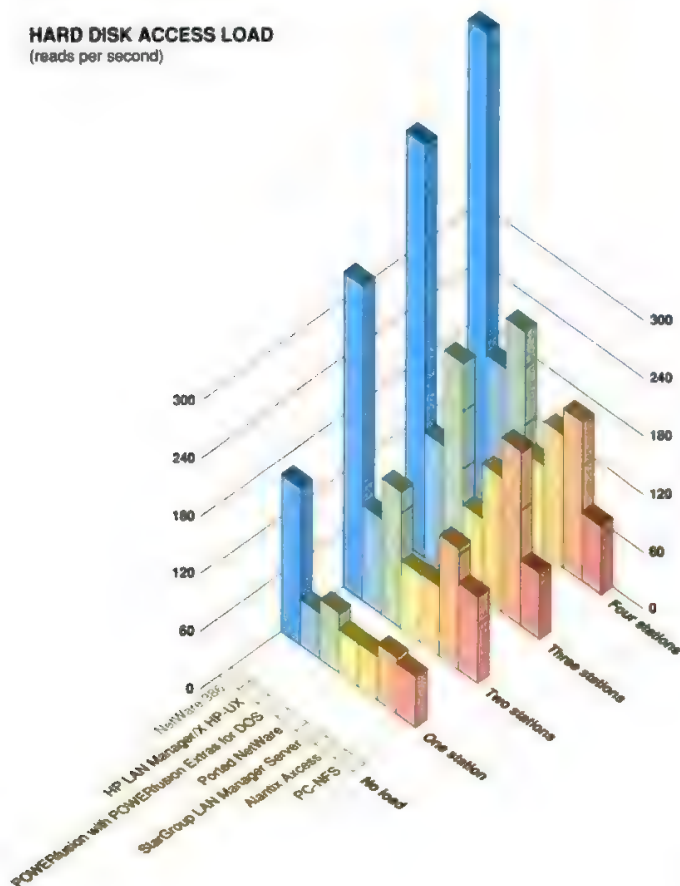
The combination of *POWERfusion* and *POWERfusion Extras for DOS* from Performance Technology also delivered

SYSTEM LOAD TESTS

(Taller bars represent better performance)

HARD DISK ACCESS LOAD
(reads per second)

DIRECTORY ACCESS LOAD
(transactions per second)



provides an equivalent interface known as the Transport Interface. In *LAN Manager/X*, the redirector runs over a TCP/IP stack and emulates NetBIOS. The server program here interacts with computers on the network through the TCP/IP stack.

In keeping with the normal *LAN Manager* client software approach, both HP and AT&T's products offer BASIC and Enhanced DOS redirectors. The BASIC redirector uses the old *MS-Net* command line utilities and does not sup-

port Named Pipes, Mail Slots, or *LAN Manager* APIs. The Enhanced DOS redirector, however, uses the new APIs; it operates faster and permits full network administration.

HP's BASIC redirector uses 99K bytes of memory while the Enhanced-DOS version takes 129K bytes. If you have expanded memory, the numbers drop to 60K and 89K, respectively. AT&T's BASIC redirector uses 135K bytes of memory (the company says its next ver-

sion will use less memory) while its Enhanced DOS version takes 170K bytes; with expanded memory, only 72K or 117K, respectively, is required.

AT&T enhanced its BASIC redirector to include the Messenger service that allows clients opting for low memory overhead to still send and receive messages; HP does not include the Messenger service in its BASIC redirector.

Both *StarGroup* and *LAN Manager/X* include programming hooks to permit

exceptional performance. While other products running on the same Dell hardware staggered while performing both throughput tests under a load of three PCs, the *POWERfusion* products moved along at a pace nearly as fast as the high-powered HP server.

The relatively simple *PC-NFS*, paired with Sun's *NFS*, gave decent performance for one- or two-station loads, but its scores fell to the bottom under heavier loads. The *NFS* scheme is used so widely that performance will vary significantly with both the hardware and the implementation of Unix used.

Interactive Systems' *Ported NetWare* made a poor showing. Since this was the only implementation of Novell's *Portable NetWare*, we aren't sure where to point fingers. Similarly, AT&T's *StarGroup LAN Manager Server* dragged. We used a different server and 10BaseT adapters for the test of the AT&T system, but all of the elements of the system are AT&T products, and the configuration is typical of what a buyer of AT&T products would have.

Notice how in the single-node throughput tests all the products, even native *NetWare 386*, slow down when running three or four stations on the access load

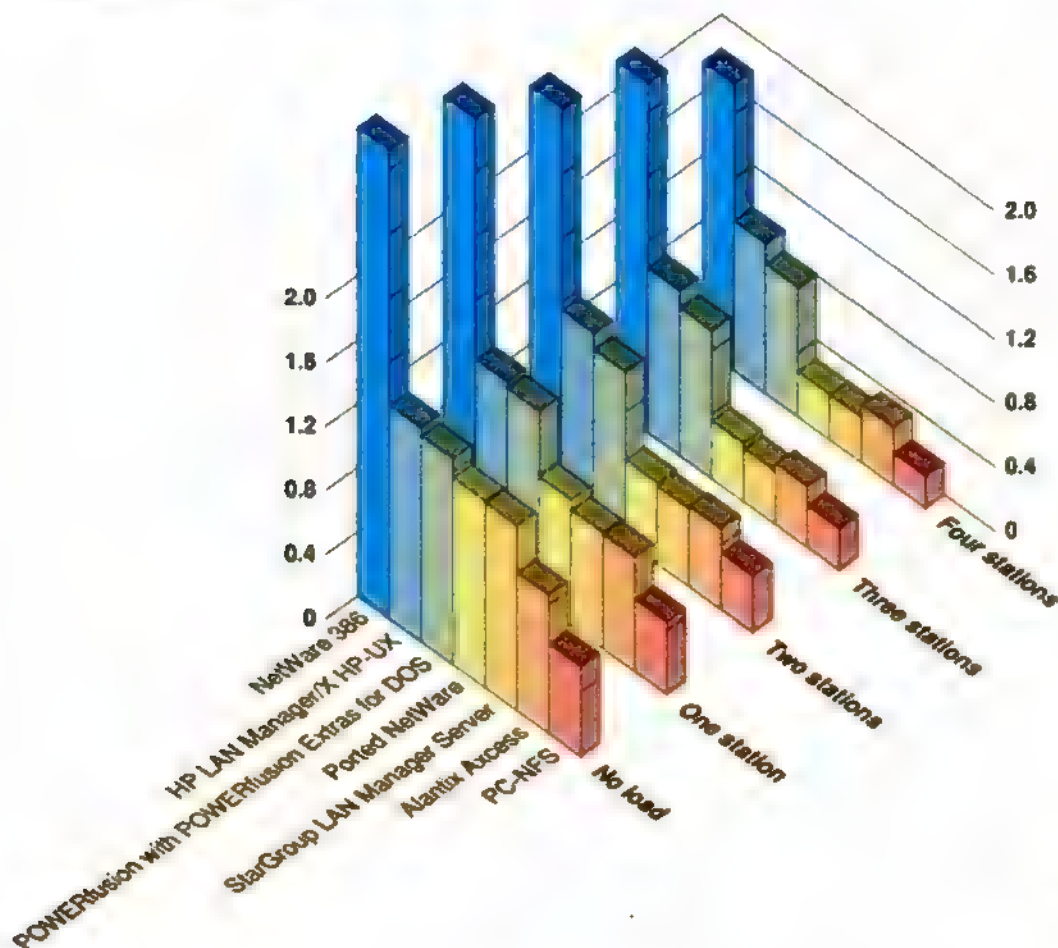
tests, plus the throughput test on one station. With the incremental addition of load stations, the increase in CPU activity gradually dragged down all the systems.

These test results are only valid for gross comparisons because the server and adapter hardware were not held constant. The results do show that products like the *POWERfusion* family can support large networks of busy PCs and still deliver throughput of nearly a megabit per second to individual nodes. Unix has a definite role as an operating system for network servers in many organizations.

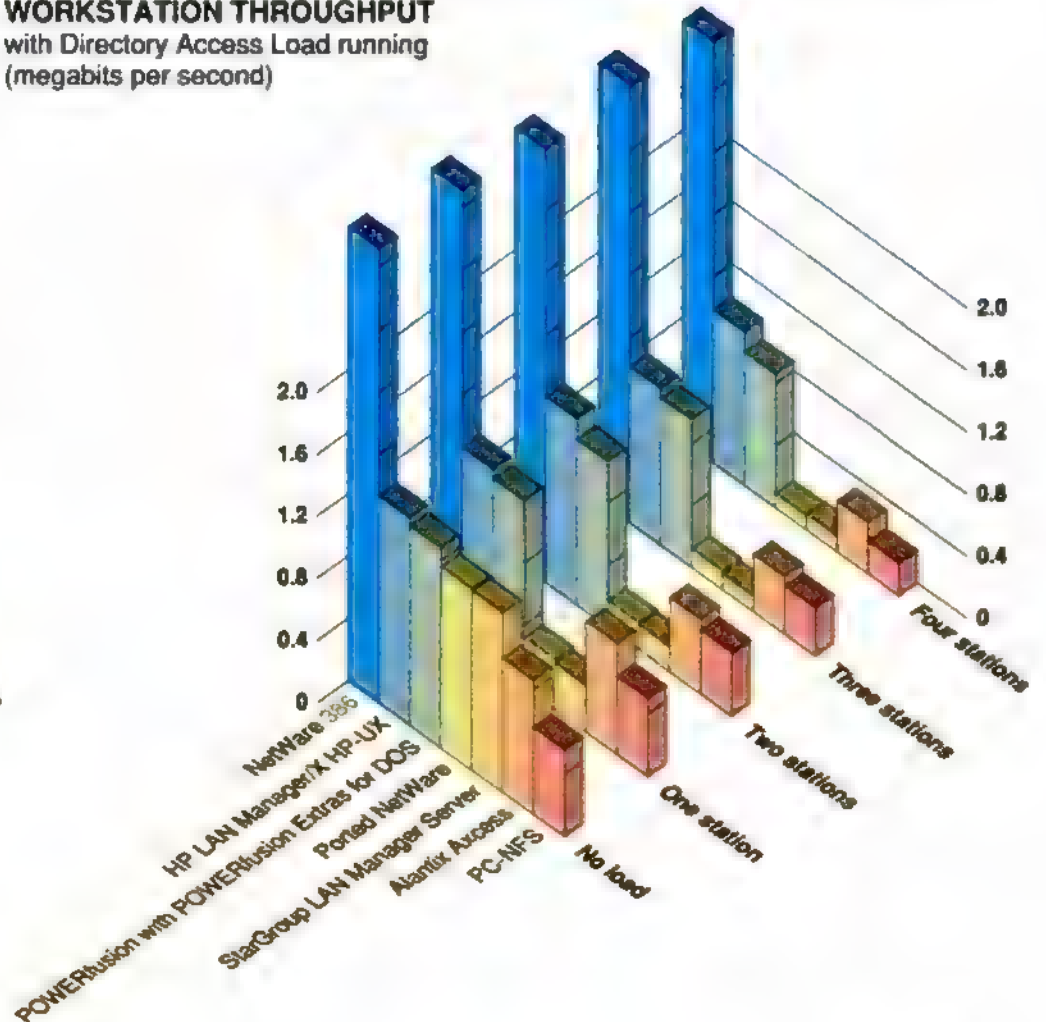
SINGLE-NODE THROUGHPUT TESTS

(Taller bars represent better performance)

WORKSTATION THROUGHPUT
with Hard Disk Access Load running
(megabits per second)



WORKSTATION THROUGHPUT
with Directory Access Load running
(megabits per second)



ENDS

programs running over Unix, OS/2, and DOS workstations to simultaneously access the same file on the Unix server. While this sounds good in theory, few if any applications have implemented this feature.

ADMINISTRATION

LAN Manager/X is missing some vital components. HP chose not to incorporate the ability to assign rights to resources for groups of *LAN Manager* users in *LAN*

Manager/X. Instead, the administrator manages groups of users through HP-UX's *SAM* utility. This program is available only from the server console or from a terminal connected to the console. While this is acceptable for people with extensive Unix experience, it does not make for an easy transition from the PC world.

Administering a *StarGroup* server is simple from both OS/2 and Enhanced DOS redirector workstations. AT&T ported Microsoft's OS/2 *NetAdmin*, a

character-based SAA-compliant program designed to administer *LAN Manager* networks, to both DOS and Unix. This allows the administrator to control the network from any computer.

StarGroup's Activity Monitor displays statistics summarizing total server usage, as well as file and print service requests made by individual clients. It displays the information on-screen and updates it every few seconds. To administer a *LAN Manager/X* network, you must be logged

on to HP-UX as the ROOT or SUPER user. You then issue commands from the HP-UX prompt. This command line style of administration needs improvement.

OTHER FEATURES

Both products include a simple message system that allows you to send short notes to other users on the network. This is not intended to replace e-mail, but it does allow quick communication with other network users.

StarGroup allows users to use their PC as a direct Unix terminal, eliminating the need for an extra terminal and its cables. Each user, with the proper permissions, can log on to Unix and access any other Unix applications, such as an accounting package.

Both *LAN Manager/X* and *StarGroup* use Unix's LP print spooler to manage network print jobs, but this is where the similarity ends. *LAN Manager/X* uses a

CONNECTIVITY UNIX SERVICES

cryptic command line interface to control and display the print queues. Users access *StarGroup*'s print spooler through a full-screen, function-key-driven program running on the server and through the NetAdmin program on any OS/2 or Enhanced DOS client station.

Client printer sharing is a rapidly growing area of concern for network users. HP does not support workstation printers, severely limiting the administrator's network design options. Although previous versions of *StarGroup* supported workstation printers, Version 3.4 provides better performance with the inclusion of LaserTools' *PrintCache* software on DOS client PCs. HP-UX, and consequently, *LAN Manager/X*, do not support the hidden, system, and archive bits for DOS or OS/2 files, which makes doing periodic backups difficult. AT&T does not have this problem.

Another *StarGroup* utility allows you to create custom menus for DOS users. The QuickMenu system provides users with a simple menu-based system for accessing network resources and performing network functions.

Companies interested in using a Unix computer as a network server for DOS-based PCs will also be interested in a wide variety of connectivity options. Both AT&T and HP offer many enhancements to their *LAN Manager*-based products, including Macintosh client support, TCP/IP software, gateways, and routers. But only AT&T supports multiple protocols that allow *StarGroup* servers to be seen on IBM LAN Server networks.

For compatibility with their respective operating systems in testing, HP provided an HP Apollo Series 9000 400 computer equipped with a Motorola 68040 processor and 8MB of RAM; AT&T provided a 33-MHz, 80386-based AT&T 6386E/WGS system equipped with 16MB of RAM.

The 50-MHz processor in the Apollo Series 400, and the tight integration of the software and adapter with the company's system, resulted in *LAN Manager/X* getting the edge over all the other systems on our benchmark tests. In this area, if in few others, AT&T's product fell significantly behind its *LAN Manager* competitor—while HP's scores were at the top of the set on our benchmark tests, *StarGroup* dragged along at the very bottom.

Support and service are strong selling

points for both companies. Both HP and AT&T have an excellent reputation for supporting their customers, albeit at a price. AT&T offers support for 90 days on a toll-free number at no cost for *StarGroup* users. After that, plans ranging from toll-free phone-in support to 4-hour on-site service are available from the company, at a price. HP on the other hand, does not include any free or toll-free support with *LAN Manager/X*. Like AT&T, however, it does provide a range of support plans in a variety of configurations, one of which should meet your service needs.

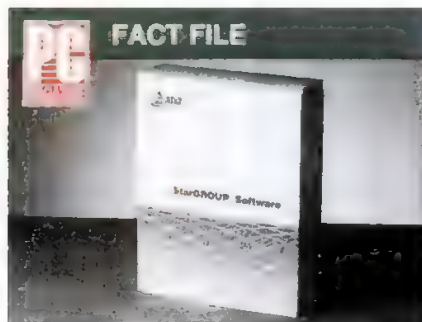
LAN Manager/X provides a solution for companies already owning HP computers that they want to use as servers for a network of DOS and OS/2-based PCs. Running on one of the 9000 series machines, the program is particularly fast. *StarGroup* benefits by including many extra features that most companies want and need. These features put AT&T's product way ahead of HP's. *StarGroup* provides users with the ability to act as a terminal to Unix over the network, remotely execute Unix commands on the server, and share workstation printers, among other attractions. Additionally, while AT&T specifies only that *StarGroup*, Version 3.4, will work with its AT&T computers and certain Compaq models, you can probably implement it successfully on many PCs that can run AT&T's Unix platforms, including HP's Vectra systems. Its only drawback is the slow speed it exhibited on our benchmark tests.

PC-NFS

by Paul Ferrill

If you own a Unix workstation or PC running any version of SCO Unix or Interactive Systems Unix with the NFS (Network File System) protocols, Sun's *PC-NFS* and an Ethernet interface card will allow your DOS workstations to access your Unix box as a server. At a cost of \$325 per node, *PC-NFS* provides a low-cost option for integrating a small number of DOS-based PCs with a Unix host. The price may not be such a bargain for a large installation, since Sun Microsystems' software scheme does not provide a peer-server arrangement for *PC-NFS*, although volume discounts are available.

It's important to understand that *PC-NFS* runs only in the DOS PCs acting as network clients, where it implements the



StarGroup LAN Manager Server, Version 3.4

AT&T Computer Systems, One Speedwell Ave., Morristown, NJ 07960; 800-247-1212. **List Price:** For unlimited number of users, \$3,795; entry-level package including two-user Unix, eight-user *LAN Manager* Server, eight-user PMX/Starmail, \$2,595.

Requires: For server: AT&T 6386/WGS, AT&T StarServer E or S, Compaq 386/33, or Compaq 386/25; 5MB RAM; Unix System V, Release 4.0, Version 2.1 or later; AT&T StarLAN or StarLAN 10 Network Access Unit (NAU), Ethernet card, or IBM Token-Ring card. For client: 135K RAM; DOS 3.1 or later; OS/2 Standard Edition 1.1; AT&T StarLAN or StarLAN 10 NAU, Racal InterLan or 3Com Ethernet card, or IBM or Proteon Token-Ring card.

In Short: In terms of features, *StarGroup*, Version 3.4, is simply the best Unix implementation of *LAN Manager*. AT&T maintains compatibility with earlier versions of *StarGroup* and adds support for NDIS. Excellent security, a BASIC redirector enhanced with a message service, an Activity Monitor that displays statistics summarizing total server use, support for workstation printer-sharing, and a host of other extra features make this a worthwhile choice. Its only drawback is throughput, which is on the slow side.

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THE DEC CONNECTION: Linking DOS and OS/2 PCs to DEC's Ultrix

by Frank J. Derfler, Jr.

There was a time when the people at Digital Equipment Corp. harbored ambivalent feelings toward Unix. For much of the 1970s and 1980s, many of DEC's customers used versions of AT&T's Unix operating system, meaning that a lot of Digital's hardware was not running its own competing system, VMS. Seeking a more flexible stance, Digital recently announced Ultrix, an implementation of Unix designed for Digital hardware. The Ultrix operating system offers an alternative to VMS on machines as diverse as the \$10,000 DECsystem 5100 and the \$190,000 DECsystem 5800 RISC minicomputers, along with a wide variety of older-architecture VAX computers.

Several products on the market already provide VMS computers with the ability to act as servers for networks of PCs running DOS. Digital itself markets such a product; after several name changes, the company now calls it *Pathworks for VMS*. In addition, Novell markets *NetWare for VMS*, a product apparently developed without cooperation from Digital. Until January of this year, Digital had not offered a similar product for Ultrix, except for the standard services of NFS that come with the operating system.

In the beginning of the year, Digital introduced its \$150 version of Microsoft's *LAN Manager*, called *Pathworks for Ultrix*. According to DEC, *Path-*

works contains all of the basic capabilities of the AT&T and HP implementations of *LAN Manager*.

For the client PCs, the *Pathworks for DOS* software costs \$195, and *Pathworks for OS/2* costs \$295 for a client license. These packages are typical *LAN Manager* redirector and NetBIOS products, with the ability to use adapters following the NDIS protocols, and use of memory above 640K with HIMEM.SYS. None of the new products were available for review at press time.

Pathworks for Ultrix also supports many e-mail programs, including the Simple Message Transport Protocol and Digital's *VAXmail*. The client package includes TCP/IP capabilities, allowing applications and utilities using TCP/IP to work across the network with the Ultrix system. The *Pathworks for DOS* package also includes *DECnet-DOS*, a peer-to-peer networking program built on Microsoft's older *MS-Net* software.

Digital, one of the strongest proponents of *Microsoft Windows 3.0* and graphical user interfaces, includes a VT320 terminal emulator in *Pathworks for DOS*, designed to run under *Windows*. The company also sells a version of the X Window system called *PC DEC Windows*, priced at \$780 for the server software and documentation. (*Pathworks for DOS* includes the client software.) This product allows a PC user to execute and display an *Ultrix DECwindows* application in one

window and a *VMS DECwindows* application in another.

If you're running a network of Digital computers and plan to expand your use of Digital products while simultaneously linking them to other network systems, *Pathworks for Ultrix* promises to provide an excellent and inexpensive path. With this product, Digital intends to give users a way to link PCs running DOS and OS/2 to Digital's own RISC and VAX hardware and other computers running *LAN Manager* and NFS. ■

Pathworks for Ultrix

Digital Equipment Corp., 146 Main St., Maynard, MA 01754-2571; 508-493-5111.

List Price: Server software, \$150.

Requires: VAX system or RISC-based system (DECsystem), Ethernet card.

CIRCLE 424 ON READER SERVICE CARD

Pathworks for DOS

Pathworks for OS/2

List Price: \$195 per DOS PC client user; \$295 per OS/2 PC client user.

Requires: 640K RAM; IBM XT, AT, 286, 386, 486, PS/2, or compatible; Ethernet card or asynchronous connection.

CIRCLE 425 ON READER SERVICE CARD

PC DEC Windows

List Price: Server software, \$780.

Requires: 640K RAM (1MB to 4MB recommended); IBM AT, 386, 486, PS/2, or compatible (depending on X Window application being run); Ethernet card.

CIRCLE 426 ON READER SERVICE CARD

Sun NFS client software. For the Unix host, you'll typically get the NFS services from the company providing the Unix operating system. Sun sells every workstation it makes with NFS as part of its operating system, even if the machine isn't for Unix. NFS is also standard on most leading competitors' workstations, including those from DEC, HP-Apollo, and Silicon Graphics.

NFS itself handles the problem of making the hard disk on the Unix host act like a local drive on the client PCs. NFS

protocols like RPC (remote procedure calls) and XDR (external data representation), along with some sample programs, are in the public domain, allowing anyone with the time and talent to create NFS-compatible software. Since Unix systems use TCP/IP to communicate, *PC-NFS* provides a full TCP/IP implementation.

A new product we looked at, *PC-NFS LifeLine* (\$125 per node), adds electronic mail and remote backup capability to *PC-NFS*. With *LifeLine*, *PC-NFS* users can send and receive e-mail among

their PCs and the Unix host machine. In addition to e-mail, *LifeLine* provides a remote backup capability, allowing the transfer of client-PC files onto the tape backup system of the host.

INSTALLS ITSELF

Even for those without much expertise in Unix systems, the NFS application is easy to activate on a Sun host machine. On the client-PC side, *PC-NFS* practically installs itself. Sun provides drivers for Ethernet adapters from Racal Inter-

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486/25i was awarded the publication's highest honor: Product of the Year. This was the fourth award given to an Elegance 486 system ... no other company comes close!

PC Magazine says "Editors' Choice!" When reviewing 486/25 systems, they said "Only one machine stands out ... you could pay less for a 486 system, but not get the bonuses that are offered with the Elegance."††

In the February 12, 1990 issue, *PC Magazine* declared Elegance 486/33 Editors' Choice, saying the system was "a sure winner in its class."



Elegance 486/25i, Sept. 11, 1990
Elegance 486/33i, Feb. 12, 1990

Computer Shopper readers agree! Elegance 486/25i breezed past the competition and captured a 1990 "Best Buy" award. This makes three years in a row, a Northgate Elegance system was voted tops by *Computer Shopper* readers.



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- 1.2Mb and 1.44Mb floppy drives
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- Vertical "Power" case (desktop available)
- 16-bit VGA graphics adaptor with 512K video RAM (expandable to 1Mb)
- 14" SVGA color monitor
- OmniKey®/ULTRA keyboard
- MS-DOS 4.01 or 3.3 and GW-BASIC software installed
- Microsoft® Windows™ 3.0 and mouse
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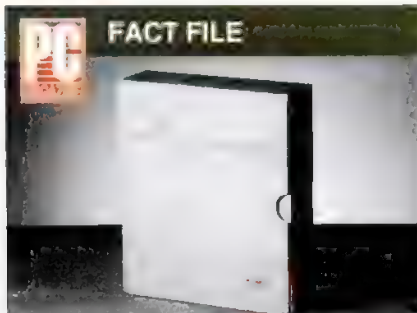
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PC-NFS, Version 3.0.1

Sun Microsystems Inc., 2550 Garcia Ave., Mountain View, CA 94043; 800-872-4786 ext. 5.

List Price: Sun PC-NFS, \$325 per user. Sun PC-NFS LifeLine Mail and Backup, \$125 per user.

Requires: For server: DEC, HP Apollo, IBM, Silicon Graphics, Sun, or any other server with NFS installed; 4MB RAM; Racal InterLan, 3Com, Ungermann-Bass, or Western Digital Ethernet card. For client: 80K RAM; DOS 3.1 or later; OS/2 Extended Edition 1.2; Acer, AST, Cabletron, CNet, D-Link, IMC, NetWorth, Racal InterLan, Research Machines, Standard Microsystems, 3Com, Tiara, Tigan, Ungermann-Bass, Western Digital, or Zenith Ethernet card, or Xircom Pocket Ethernet Adapter.

In Short: The PC-NFS software uses TCP/IP protocols and its own redirector to make a PC a client of a Sun or any other Unix computer that acts as an NFS host. The PC-NFS LifeLine package adds remote backup and e-mail capability at an affordable price. Basic versions of FTP and other utilities complete the TCP/IP implementation and make the product a low-cost but slow alternative for connecting a small number of PCs to a Unix host. The node-based pricing structure makes it expensive to connect many client machines.

CIRCLE 844 ON READER SERVICE CARD

With PC-NFS, the network printer spooling and administration is all done through Unix. You must be familiar with Unix conventions and utilities to do much more than use the redirected drives on an NFS network. The printer redirection capability also allows a client PC to send print jobs to the server through DOS commands or applications.

The LifeLine product installs as a 60K TSR. Notification of e-mail comes with a beep and a short message at the bottom of your screen. You can choose to read it and reply immediately, or wait until later. The backup portion of LifeLine functions similarly to the normal DOS BACKUP command. Unix's own standard tar (short for "tape archive") program receives the data from either the local disk of the client PC or the mounted files on the host, and then saves them on a cartridge tape drive.

Sun provides free technical support at a toll-free number for 90 days. Afterward, software support costs \$39 per month. Electronic mail via the Usenet or Internet network offers another path to send questions to the company. Sun also operates offices in most large cities across the country where you can go for service.

We evaluated PC-NFS on a Dell System 433E with a 80486 processor running at 33 MHz with 16MB of memory. PC-NFS gave credible performance results, but only for one- or two-station loads. With three- or four-station loads, the program performed poorly.

PC-NFS supplies a simple solution to the problem of integrating DOS-based PCs into a Unix environment, although you won't get the performance of a NetWare or LAN Manager network. If you need to connect a small number of PCs, this path may be the most economical route, but for larger numbers of client machines the cost can get high.

Ported NetWare

by M. Keith Thompson

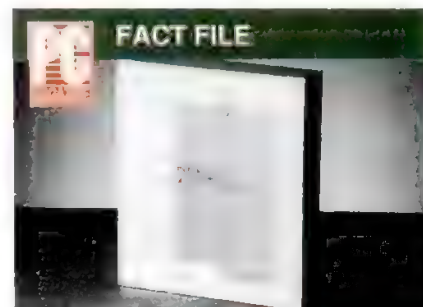
Novell indirectly offers a way to integrate a Unix server seamlessly into a NetWare network. Interactive Systems Corp.'s Ported NetWare is a version of Novell's Portable NetWare, which Novell itself does not sell to users. Instead, the company licenses the source code to a version of NetWare 386 that OEMs can mold and

tailor to run on their machines and operating systems.

Unix is the primary target platform for the product marketed by Interactive, which sells for \$4,995 for an unlimited number of users. Ported NetWare proved to be the easiest of the packages we reviewed to integrate into an existing NetWare environment, but it provides slower throughput than some other solutions.

Ported NetWare operates as a series of processes on the host under Interactive's Unix, Version 2.2. Users attached by terminals to the Unix host computer can access files through Unix applications, while those on PCs access the same files through DOS or OS/2 applications. In addition, DOS PCs can run other Unix applications, acting as terminals connected by the network cable.

The current version allows only one network adapter in the server. This limitation may reduce the potential throughput of the server and the flexibility you have in planning your network. The marketing staff at Interactive claims the next release will allow up to 15 network cards in the server. Currently, the product lets you use



Ported NetWare, Version 3.0

Interactive Systems Corp., 2401 Colorado Ave., Santa Monica, CA 90404; 800-346-7111, 213-453-8649.

List Price: For unlimited number of users, \$4,995.

Requires: For server: 386 or 486 processor; 4MB RAM; Interactive Unix, Version 2.2, or 386/ix, Version 2.02; Novell, Racal InterLan, 3Com, Ungermann-Bass, or Western Digital Ethernet card, or Western Digital Token-Ring card. For client: 70K RAM; DOS 3.01 or later; OS/2, Version 1.2; CMC, Racal InterLan, 3Com, Tiara, Ungermann-Bass, or Western Digital Ethernet card.

In Short: Ported NetWare offers all of the management and user options of its native Novell brother, but provides significantly slower throughput. Because it integrates transparently with a Novell network, this product should be attractive to an organization with a need to make easy connections between a Unix computer and NetWare client PCs.

CIRCLE 842 ON READER SERVICE CARD

Lan, 3Com, Ungermann-Bass, and Western Digital, but other boards also work with PC-NFS. A handy utility program called MYEADDR will read the Ethernet address from some boards, such as the 3Com 3C501 board. Otherwise, the install program prompts for this address.

The name and Internet address of the host server machine rounds out the information needed to complete the installation procedure. Once you answer all the questions, the install program proceeds to modify the CONFIG.SYS and AUTOEXEC.BAT files on the client to load the correct drivers and start the redirector.

PC-NFS then issues a NET USE command through a batch file and links the next available disk drive on the client workstation to a disk volume on the host machine. The full implementation of PC-NFS occupies just over 80K on each workstation, including the NFS redirector and TCP/IP elements and utilities.

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network adapters such as 3Com's 3C501, 3C502, or 3C503, as well as Novell's NE2000 or a card from Racal InterLan or Western Digital.

PAINLESS CLIENT SUPPORT

If you are a *NetWare* user, you are probably familiar with the SList utility that generates a list of available *NetWare* servers. One of the most important things about Interactive's *Ported NetWare* is that a Unix server running it appears on SList as a typical Novell file server. All applications that run over standard *NetWare* integrate transparently into this environment.

The normal DOS, Macintosh, and OS/2 redirectors work to connect users to all types of *NetWare* servers. Interactive does not include the OS/2 redirector with *Ported NetWare*, but supplies it to customers at no charge upon request.

On the client side, you use standard Novell redirector and driver software. If you have an existing Novell network, you don't have to make any changes to the client PCs in order to use *Ported NetWare*. Like Novell's client-PC *NetWare*, Interactive's products can use high, extended, or expanded memory, and connect with practically every type of network adapter manufactured for the PC. Installing the Interactive package is not as simple as setting up *NetWare 386*, but easier than *NetWare*, Version 2.1.5.

Ported NetWare also has the ability to work with TCP/IP and NFS over the same adapter. This capability provides transparent access to data files and applications across multiple networks. For example, you can use NFS to link your Unix host to NFS on an HP minicomputer, and then use resources on the HP from your DOS client.

FAMILIAR NETWORK CAPABILITY

Network administration ranks high on the list of criteria for selecting a network operating system. With *Ported NetWare*, network administrators familiar with *NetWare* don't need to learn any new commands. The standard *NetWare* utilities SysCon, Filer, and PConsole all work the same way on a *Ported NetWare* server as they do on other *NetWare* servers, and *Ported NetWare* contains the standard *NetWare* security features. Interactive also supplies network management utilities running under Unix, permitting administration from any node on the network.

Even though *Ported NetWare* uses the Unix print spooler, you still have access to

the print queues from the standard PConsole utility. Users can also employ the *NetWare* NPrint command to print their files as usual.

Interactive also offers *SMB/ix* with *Ported NetWare*, as a \$900 option. This utility runs in the server and provides compatibility with client PCs running SMB software, such as *LAN Manager* or DCA's *10NET*, and SMB-compatible network protocols, like NetBEUI and XNS.

PERFORMANCE PROBLEMS

The dark side of this otherwise bright picture of compatibility is performance. This product did not perform very well in our throughput tests; under the combined load of several busy client stations, its scores dropped into the low range. They were particularly poor under multiple stations on the Directory Access Load Test. With standard *NetWare 386*, data moves at 2 to 3 megabits per second

on our Hard Disk Access Load Test but with progressively heavier client station loads, *Ported NetWare*'s throughput ranged from 0.78 down to 0.28 megabits per second.

Interactive includes good documentation with *Ported NetWare*. The company offers a variety of support plans for its products, including a unique 30-day support plan that goes into effect only upon your first inquiry. After those 30 days have passed, Interactive offers support on a per-call basis as well as yearly support plans. A toll-free number is available for installations with support contracts.

The ability to turn your Unix computer into a *NetWare* server easily accessible from DOS-based *NetWare* client PCs gives *Ported NetWare* a significant advantage over its competitors. But the slow performance of the software would argue for matching a *Ported NetWare* server with one running native *NetWare*, allowing users the benefits of speed and access to the files on the Unix computer.

MICRO COMPUTER SYSTEMS: An Up-and-Coming Competitor

by Frank J. Derfler, Jr.

Micro Computer Systems (MCS) has long been in the business of selling small pieces of a total DOS-to-Unix solution to much larger companies, including AT&T, NCR, Siemens, Unisys, and Xerox. But by the time you read this, it plans to be marketing its own products through retail channels. Since its software has been around for a while, MCS has the potential to become an important player in the retail DOS-to-Unix market.

The heart of MCS's product line will lie in two programs, *SMB/ix* and *NetBIOS/ix*. When they run over SCO Unix, the \$995 *SMB/ix* and \$495 *NetBIOS/ix* will give the Unix computer the ability to act as an SMB server for PCs running SMB-over-NetBIOS software marketed by many different companies, including Atlantix, DCA *10NET*, all of the *LAN Manager* vendors, Performance Technology, and others.

MCS plans to provide *NetBIOS/ix* modules conforming to the NetBEUI, RFC 1001/1002, TOP, and Unger-

mann-Bass NetBIOS specifications. Since NetBEUI is the extended NetBIOS developed by IBM for Token-Ring networks, RFC 1001 and 1002 are specifications associated with TCP/IP, and TOP is associated with a protocol stack conforming to the OSI model, MCS's *NetBIOS/ix* should conform to some of the industry's major standards.

MCS is also realigning its product line by bundling client/server features into its *TRIAC/pc* package. *TRIAC/pc*, priced at \$595 for five nodes, will provide a peer-to-peer network program able to address SMB and XNS servers. According to MCS, *TRIAC/pc* will support a variety of network adapters marketed by AT&T, IBM, Novell, and Ungermann-Bass.

When they're released, these products will compete with products like *Atlantix Access* and *POWERfusion* as ways to merge DOS-based PCs into computers running SCO Unix. For more information, you can contact MCS at its headquarters in Irving, Texas (214-659-1514). ■

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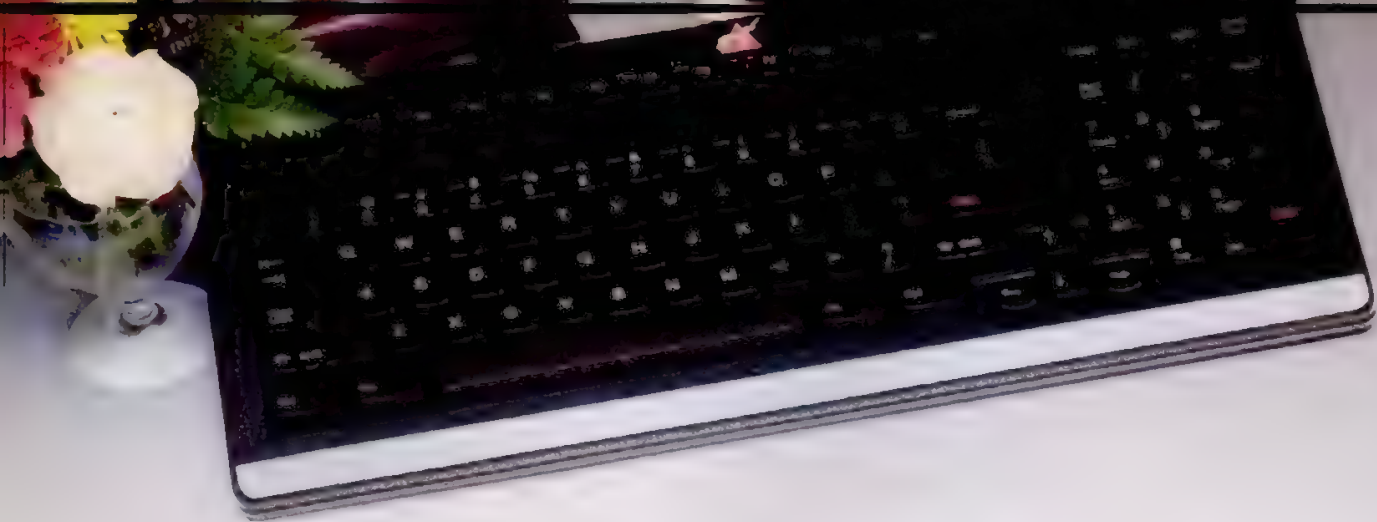
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PC Sources, 11/90*

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*Tracy Licklider
BCS UPDATE, 7/90*

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*Matt Ross,
PC Magazine, 9/25/90*

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*Bill Machrone,
PC Magazine, 1/15/91*

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*Computer Shopper,
1/91*

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*Stan Miastkowski,
BYTE, 6/90*



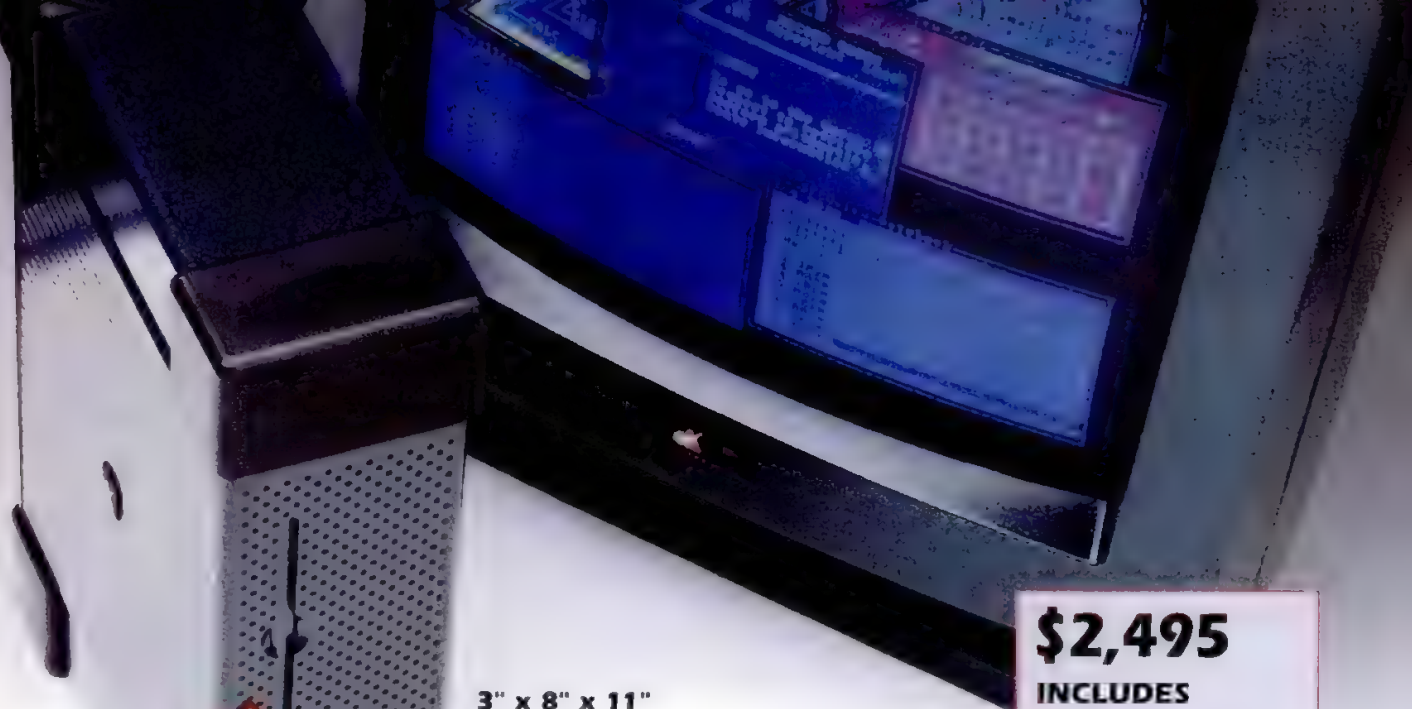
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PC Week, 9/24/90

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Eric Grevstad,
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POWERfusion with POWERfusion Extras for DOS

by Paul Ferrill

The *POWERfusion* family of products from Performance Technology provides a complete and appealing package for linking a Unix server with client PCs running SMB/NetBIOS software. Performance Technology also supports peer-to-peer file and printer sharing across the network. The *POWERfusion* package for SCO Unix has an entry level price for a five-user system of \$750, or \$3,000 for an unlimited number of users.

POWERfusion works with any AT&T System V, Version 3.20 and later, release of Unix, including those from Intel, Interactive Systems, SCO, and Unisys, but Performance Technology specializes in support for SCO Unix. We ran our benchmark tests on the Performance Technology product using SCO Unix, Release 3.2, Version 2.0s. On Motorola computers, the server package requires Unix System V, Version 3.4.

The *POWERfusion* package provides only the software for the Unix machine and programs you install on the five DOS PCs allowing access to the Unix server as terminals. You need a second package, *POWERfusion Extras for DOS*, to create virtual drives on the DOS PCs and to talk to *NetWare*. Any version of *POWERfusion Extras* can connect any number of DOS users to a Unix station simultaneously. You can choose among variations of the package, including a \$750 version of *POWERfusion Extras* for simultaneous peer-to-peer connections between five DOS users, a \$1,500 version for peer-to-peer connections between ten DOS users, and \$3,000 for peer-to-peer connections for an unlimited number of DOS users. *POWERfusion Extras* offers access to the SMB server facilities of *POWERfusion* on the Unix computer. The Unix computer can also access the connected PCs' printers.

The *POWERfusion* products will appeal to anyone with a computer running the right flavor of Unix who needs to support a network of PCs.

PROGRAMS WITHIN PACKAGES

Several programs come with *POWERfusion*, Version 1.3. The Unix file server capabilities come from *POWERserve*, a

Server Message Block (SMB) interface to the Unix file system. Other programs include the NetBIOS interface for the client stations and software that provides DEC VT100 and VT220 terminal emulation services.

The *POWERserve* program functions as a Unix parent process with multiple child processes. The parent has the responsibility of monitoring the network for incoming connections from PC workstations. When a connection request comes in, the parent spawns a child process to handle the SMB requests from the workstation. Each client PC thus has its own corresponding Unix process on the file server.

POWERfusion Extras includes a DOS redirector, an SMB module, several versions of NetBIOS, and Performance Technology's *Navigate* file and directory maintenance utility (see "The Ultimate Utility Shelf," *PC Magazine*, June 26, 1990). This utility shows the directory and file structure in a full-screen, user-friendly fashion and provides a menu of functions. Performance Technology has ported this utility to the native Unix environment for Unix users; a Unix version comes in the *POWERfusion* package.

The workstation installation software for *POWERfusion Extras* uses the same system of horizontally sliding, full-screen menus found in *Navigate*. The installation process was very simple, the program was easy to use, and the configuration was easy to modify later. The installation program modifies the AUTOEXEC.BAT file to add the network start-up commands. Installation on the Unix machine uses the Unix Custom program in the same way as the *Atlantix Axxess* product. The *POWERfusion* package's connection to the server is indicated only by added drive letters.

Interestingly, the company includes a NetBIOS in *POWERfusion Extras* that is compatible with the Clarkson packet-driver standard, allowing a single network interface card to access both the *NetWare* and Unix networks simultaneously. Although Performance Technology provides a NetBIOS that can work with the packet driver, the company doesn't provide the packet driver or the IPX for the packet driver; you must get these from bulletin boards or other public-domain sources.

A 2K TSR redirector provided by

Performance Technology in *POWERfusion Extras* can make printers attached to a client workstation available to the entire network. This useful redirector takes 13.5K RAM in a PC and the NetBIOS takes a little over 7K.

Between them, *POWERfusion* and *POWERfusion Extras* can use most of the popular network interface cards, including those from CNet, Compex, Earth Systems, Gateway, Novell, NSC, PureData, 3Com, and Western Digital, as well as Xircom's Pocket LAN Adapter. They support other Ethernet interfaces including ARCnet cards using an SMC-compatible connection, which includes practically all of them. *POWERfusion* also supports remote booting for interface cards equipped with a boot ROM.

In our benchmark tests, Performance Technology lived up to its name. Running over SCO Unix, *POWERfusion* provided



POWERfusion, Version 1.3, with POWERfusion Extras for DOS

Performance Technology Inc., 800 Lincoln Center, 7800 IH-10 West, San Antonio, TX 78230; 800-877-8649, 512-349-2000.

List Price: *POWERfusion*: for five users, \$750; for unlimited number of users, \$3,000. *POWERfusion Extras for DOS*: depending on number of simultaneous peer-to-peer connections among DOS users, \$750-\$3,000. *POWERbridge*, \$995.

Requires: For server: 80386/SX or better, 4MB RAM, Unix System V, Version 3.20 or later, or SCO Unix, Version 3.0 or later; ARCnet card with SMC-compatible connections, or Western Digital Ethernet card. For client: 21K RAM; DOS 3.10 or later; ARCnet card with SMC-compatible connections, or CNet, Compex, D-Link, Novell, Pure Data, or Western Digital Ethernet card, or Xircom Pocket Ethernet Adapter.

In Short: The *POWERfusion* family of products offers a complete solution for linking a Unix server with client PCs running SMB/NetBIOS software. Easy to install, they include the *Navigate* utility for added functionality. They share files between the DOS and Unix worlds at top-flight speed, without hassles, making these products real winners.

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BRIDGING THE GAP

Performance Technology has a unique method for linking client PCs to SMB/NetBIOS servers and *NetWare* servers simultaneously. The company offers a sophisticated product called *POWERbridge* to move packets between the two networks. This technique requires the use of another adapter and the installation of special software on one PC that functions

**In our benchmark
tests, Performance
Technology lived up
to its name.**

as a bridge. The technique saves memory on all the other client PCs. The \$995 *POWERbridge* can handle many different networks, including x.25 connections and asynchronous connections.

Performance Technology is also planning a program called *NBLite*. (The Novell version of the product should be shipping by the time you read this.) While *POWERbridge* is the more sophisticated of the two products, *NBLite* will provide a NetBIOS client/server package for *NetWare* and completely replace Novell's NetBIOS emulator program. It will let the *POWERfusion* user access *NetWare* servers by connecting to a single PC that's linked to separate networks run by *NetWare* and *POWERfusion* file servers.

FILE PROTECTION AND SHARING

The Unix file protection facilities allow security measures at the individual file level. Performance Technology offers two different security modes to take advantage of these facilities. The first method, share-level security, can protect the disk volume's entire file-tree structure, a printer port, or a file. With this approach, users must supply a password for each network resource they want to use. User-level security gives the normal Unix security of read/write protection, granting access to a user, a group, or everybody. With user-level

security, each user gets a password and the network operating system knows the resources to which the user has access.

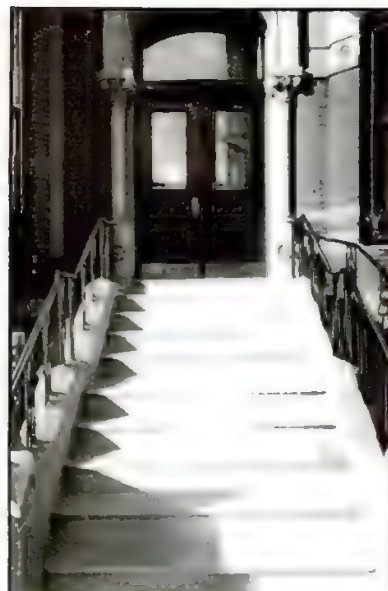
One hassle of sharing files between Unix and DOS applications concerns the use of carriage return (CR) and line feed (LF). Normal DOS text files have both CR and LF present at the end of each line. Unix uses only the LF character as a line terminator. Viewing a text file created on a Unix system can play havoc with your display. Performance Technology provides a utility named *U_CONVERT.EXE* for just such situations. The program runs on the PC and will add the missing CR character to allow proper display in the DOS environment.

Another handy function on the Unix machine involves the slash ('/') and backslash ('\') characters. While DOS uses the backslash as the subdirectory separator, Unix uses the slash for this function. The *POWERserve* program will recognize either convention for accessing files stored on the Unix machine.

Performance Technology offers a basic support package for \$250, giving one hour of 900-number technical help. Additional 900-number support costs \$2.50 per minute. The basic support also includes access to the company's bulletin board system and a year's subscription to *POWERtips*, a technical newsletter. Support from resellers is another option.

The *POWERfusion* family provides a complete, fast, and flexible internetworking package. Extra features, such as the ability to make local printers and files accessible to the network, along with the *Navigate* utility, make the system a joy to use. If you're looking for a way to connect your Unix box to a network of DOS-based PCs, look no further. ■

Kaare Christian is a research associate at The Rockefeller University, where he uses DOS and Unix systems to build scientific instrumentation. He has written a number of books on the Unix operating system and is working on a book on object-oriented programming. Frank J. Derfler, Jr., is Workgroup Systems Editor of PC Magazine. Paul Ferrill is an electrical engineer with a wide range of experience in both micro- and minicomputer systems. M. Keith Thompson is a network consultant and frequent contributor to PC Magazine.



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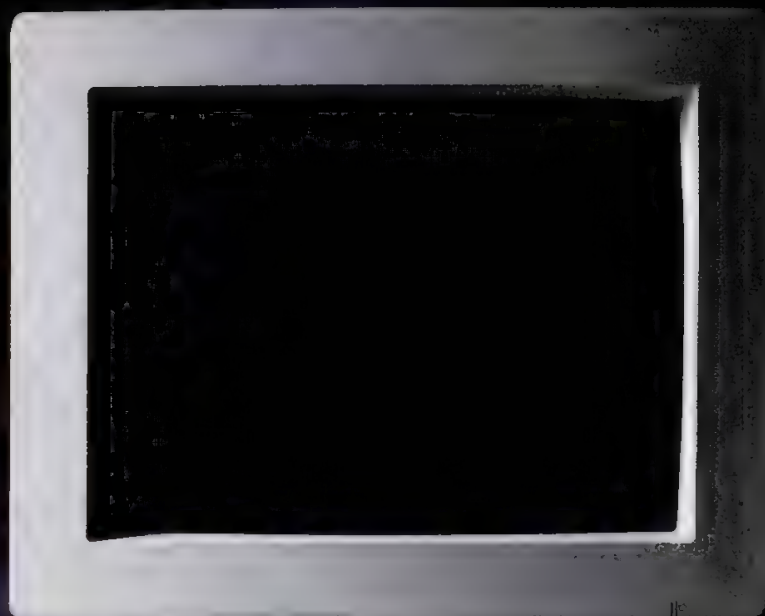
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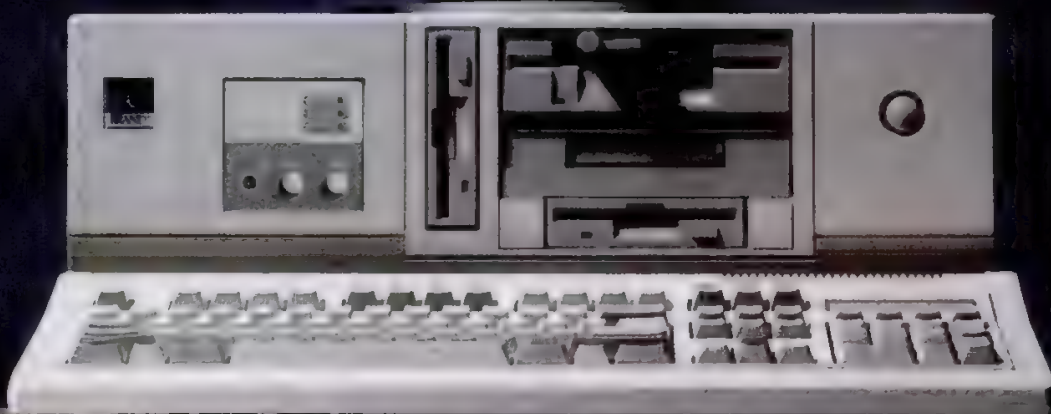
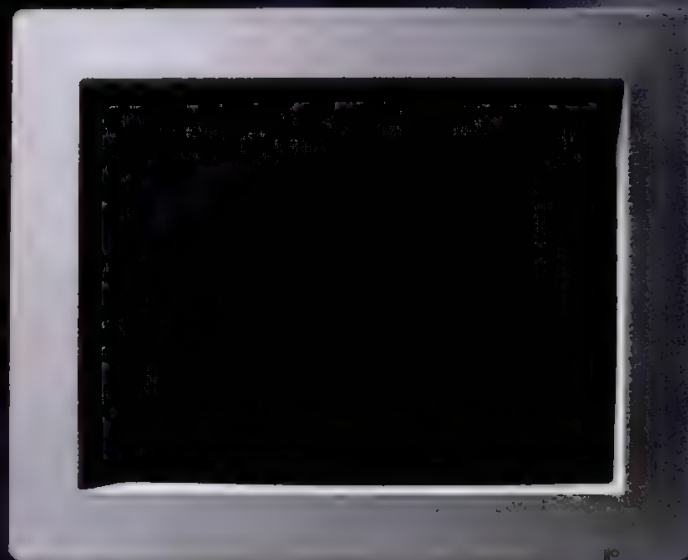
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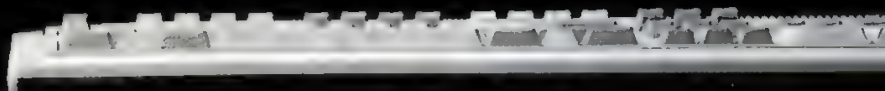
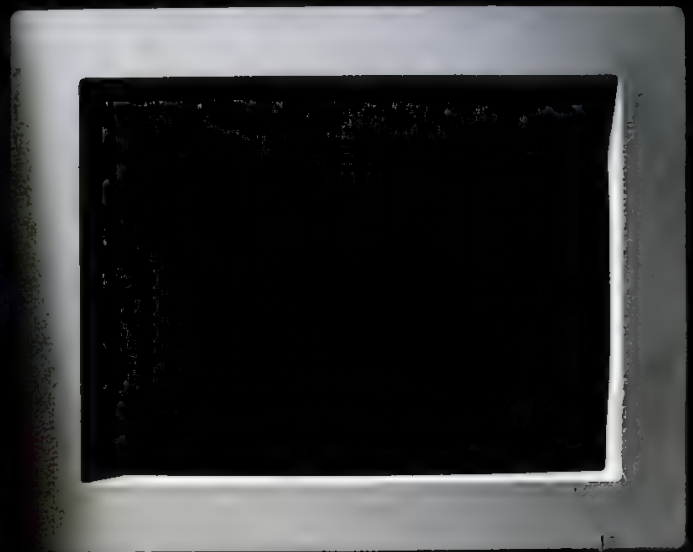
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by
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Utilities

the excitement of trying out—and who doesn't?—every new *Windows* application that you can lay your hands on, you've probably never given a thought to what effect all this experimenting has had on a small, little-documented but vital file called WIN.INI.

Each *Windows* application you install usually modifies one part—the [Extensions] section—of the WIN.INI file so that *Windows* can call up that application whenever one of its documents is selected. Further, many programs create their own independent sections in WIN.INI—often without asking your permission—for storing information from session to session. Thus, even if you wipe a program from your hard disk after running it only once, it's likely to leave a few skeletal remains in WIN.INI.

As WIN.INI fills up with all of these old program bones, you may eventually notice slightly slower response time, especially when you start *Windows*. In addition, if you ever have to go in and edit WIN.INI manually, you'll find yourself confronted with a needlessly large and complex file. It would be nice if *Windows* applications came with uninstall programs, but since they don't, I've solved the problem of WIN.INI clutter by writing PROGSET.

PROGSET is a *Windows* utility that lets you restore order to your WIN.INI file painlessly and without the possibility of corrupting it. PROGSET also fills a few gaps in the *Windows* Control Panel and File Manager by giving you complete control over the file "associations" that let you start an application by clicking on one of its files.

You can download a working copy of PROGSET.EXE from PC MagNet (for instructions, see the PC MagNet News page, which immediately follows this column). If your communications setup can't handle binary (executable) files, you can download PROGSET.BAS instead. Running this file in BASIC will create PROGSET.EXE. PROGSET is written in C, and the necessary source files for compiling it us-

Get Control Over Your WIN.INI File with PROGSET.EXE

■ This handy *Windows* utility lets you clean out the WIN.INI modifications made by discarded applications.

ing a Microsoft 5.1 (or later) C compiler can also be downloaded from PC MagNet. As an alternative, we can fax or mail you the source code listings. Simply send a postcard with your name, address, and fax number (if applicable) to the attention of Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016.

ABOUT WIN.INI

Since the *Windows* user guide supplies no documentation for WIN.INI, I think that I should explain a little about this file before beginning a discussion of how PROGSET works on it. You can get a fuller account by reading the two disk files, WIN.INI.TXT and WININI2.TXT, which you'll find in your main *Windows* directory. (You might also want to read SYSINI.TXT, SYSINI2.TXT, and SYSINI3.TXT, which cover WIN.INI's sister file, SYSTEM.INI.)

The two primary .INI (initialization) files that *Windows* needs to function are called WIN.INI and SYSTEM.INI. Basically, WIN.INI contains the settings that allow you to alter your *Windows* environment to reflect your preferences. Most of this session-to-session information is set from the *Windows* Control Panel application. SYSTEM.INI contains the settings

that customize *Windows* to match your system's hardware. Most of the data in SYSTEM.INI is set during installation or by using the *Windows* Setup application later.

The .INI files are divided into *sections* identified by an entry (which can be an application name) placed within square brackets. Both are ASCII files and can be edited manually—use great care for this and make a backup copy first—with a text editor such as *Windows*' Notepad or the undocumented SYSEDIT.EXE program located in your *Windows* \SYSTEM directory. SYSEDIT also allows you to edit AUTOEXEC.BAT and CONFIG.SYS easily. It is a multiple document editor, and it starts with each of the four files in its own edit window. Don't use a regular formatting word processor on .INI files (or on AUTOEXEC.BAT or CONFIG.SYS), however, or you'll corrupt them irretrievably. If you simply want to see which programs are installed in WIN.INI and remove one or more of them, PROGSET is a safer and easier way.

With the advent of *Windows* 3.0, Microsoft included some library calls that allow software developers to store needed session-to-session information for their applications in "Private Profile" .INI files rather than in WIN.INI. This gave the developers the ability to separate their .INI files into multiple sections per application (as opposed to one section for each application in WIN.INI). A number of *Windows* applications, including Program Manager and File Manager, do just this. Unfortunately, however, not all developers took advantage of this new functiona-

Utilities

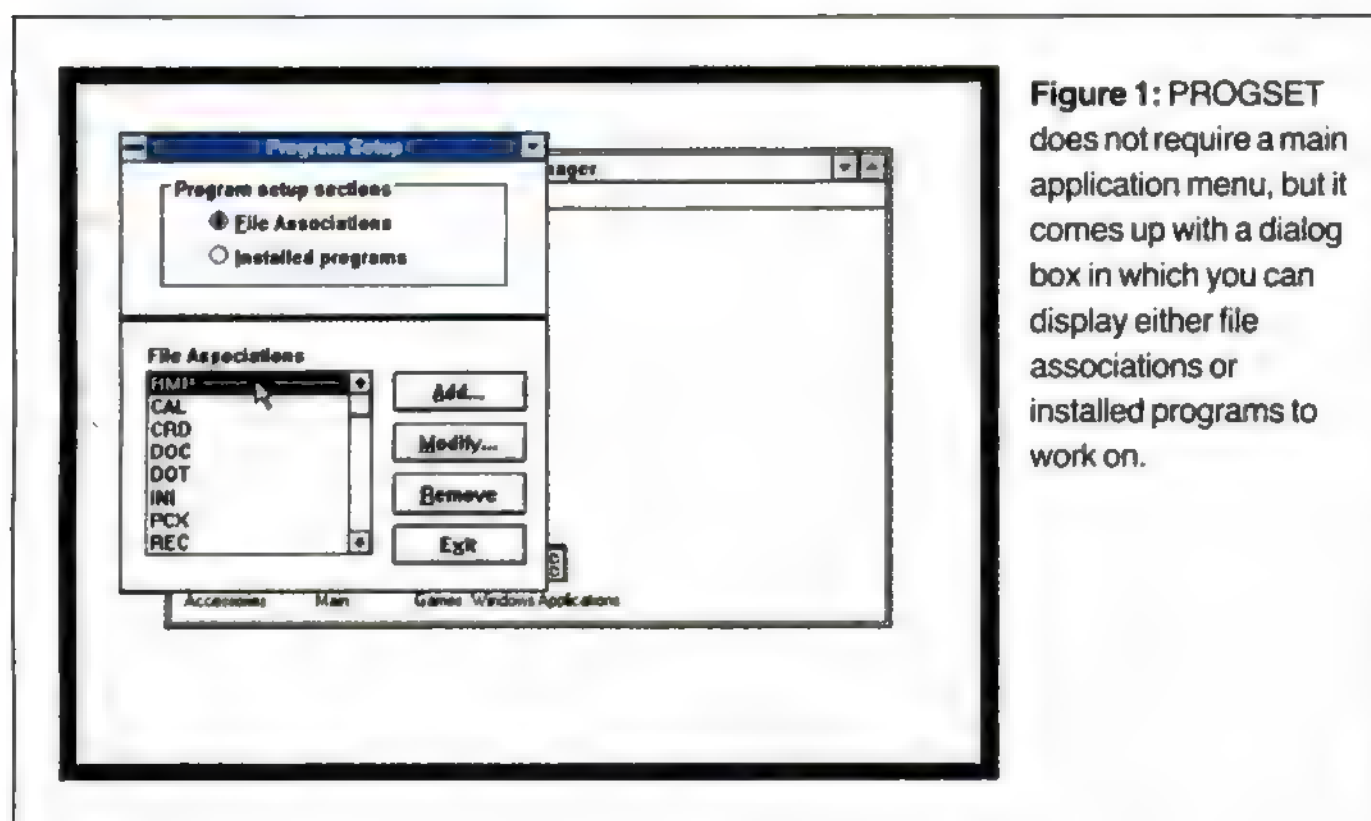


Figure 1: PROGSET does not require a main application menu, but it comes up with a dialog box in which you can display either file associations or installed programs to work on.

lity. Even Microsoft's own applications released for *Windows 3.0* don't! So you still get clutter of individual application sections in the file that controls the most important part of *Windows*—the user interface.

ABOUT FILE ASSOCIATIONS

In addition to eliminating no-longer-needed sections, PROGSET also works on the [Extensions] section of your WIN.INI file. As its name implies, the [Extensions] section contains information about file associations. File associations are used by many applications to jump-start a document file. For example, if you double-click a file with the .WRI extension in the *Windows* File Manager, it will bring up *Windows Write* with the selected document loaded. You will get the same result from the *Windows* Program Manager if you use the Run command from the File menu or if you select an icon set up for a .WRI file. Many other "shell-type" applications use *Windows* file associations in order to determine which documents belong to which applications.

If you look in your WIN.INI file under the [Extensions] heading, you will notice several lines in the following format:

```
ext=path\appname.exe ^.ext
```

In this example, ext is the file extension of the associated document, path\appname.exe is simply the name of the executable file (program) to be run, and ^.ext represents the command line parameter(s) to be passed to the application

when it's executed. *Windows* will insert the name part of the document file in place of the ^. Nobody seems to know why you must include the .ext after the ^, but you definitely need it, whether you use File Manager, PROGSET, or a text editor to set your file associations.

The first command line parameter to a *Windows* application is almost always the name of any document file to be opened when the application starts. Some applications allow you to specify more than one command line parameter. For example,

Word for Windows will accept multiple document filenames and multiple macro names separated by spaces. You can even mix macro names and filenames on the command line. The program will load all files in the order specified and then run all macros in the order specified. Thus, if you had the file association

```
C=C:\WINWORD\WINWORD.EXE ^.C
CMACRO
```

Word for Windows would open the selected .C file and then run CMACRO. If you're unsure of the command line parameters accepted (or expected) by a specific *Windows* application, you should check that application's reference.

As an alternative to using PROGSET, file associations can be set by selecting a file using *Windows*' File Manager and choosing Associate from the File menu. File Manager will prompt you for the name of the application to associate with the document extension. When you modify an association or set up a new one, you have to know the path and the command line for the application.

While the File Manager procedure works well enough to get the job done, it doesn't allow you simply to look at which file associations are installed on your system. Worst of all, the File Manager doesn't allow you to delete file associations. I feel that any piece of software with

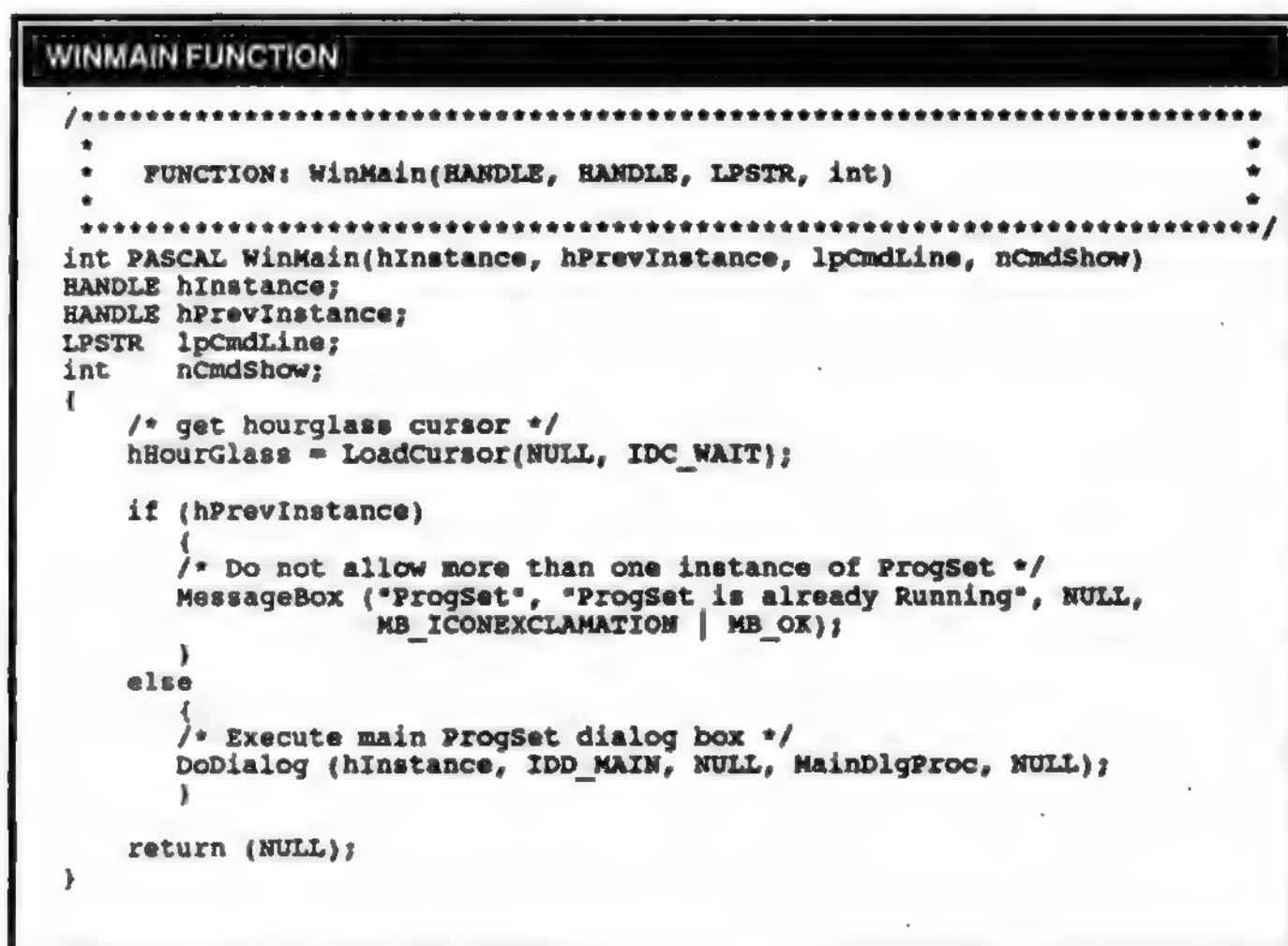


Figure 2: PROGSET simplifies coding by executing the main dialog window box with a NULL in place of the parent window handle.

Utilities

the power to create something should also give the user the power to destroy what it has created. Otherwise, more program bones end up being entombed in WIN.INI.

PROGSET is designed to do the dirty work of keeping your WIN.INI file clean. It provides you with lists both of the file associations in your WIN.INI file and of the programs that have installed themselves in it. You can add new file associations, modify existing file associations, or remove unnecessary file associations. You can also remove any sections installed by programs that you no longer want. PROGSET uses *Windows* library calls to update the WIN.INI file, so you don't have to worry about corrupting the file.

USING PROGSET

PROGSET is a relatively easy program to use. To make things even easier, you will probably want to set up an icon for PROGSET in your Program Manager Accessories group. Then, to run it under the Program Manager, you simply select the PROGSET icon. Alternatively, you can choose the Run command from the File menu and enter the full path for PROGSET. To run PROGSET from File Manager, simply locate the PROGSET.EXE file and double-click it with the mouse.

PROGSET comes up with a dialog box listing your *Windows* file associations, as

DO DIALOG FUNCTION

```
.....
*
* FUNCTION : DoDialog(hInst, lpResName, hWnd, lpProc, dwInitParam) *
*
* PURPOSE : Runs a dialog box. A dialog procedure and initial *
*           parameter are both optional. If the dialog procedure *
*           is NULL then DefaultDlg is used. If the initial *
*           parameter is NULL then DialogBox() is called instead *
*           of DialogBoxParam(). *
*
*...../
int FAR DoDialog (hInst, lpResName, hWnd, lpProc, dwInitParam)
HANDLE hInst;
LPSTR lpResName;
HWND hWnd;
FARPROC lpProc;
DWORD dwInitParam;
{
    FARPROC lpfn;
    int ret;

    if (lpProc == NULL) /* if no proc was specified, use default */
        lpProc = DefaultDlg;

    lpfn = MakeProcInstance(lpProc, hInst);

    if (!dwInitParam) /* if dwInitParam = NULL, do not pass param */
        ret = DialogBox(hInst, lpResName, hWnd, lpfn);
    else
        ret = DialogBoxParam(hInst, lpResName, hWnd, lpfn, dwInitParam);

    FreeProcInstance(lpfn);

    return(ret);
}
```

Figure 3: The DoDialog function of PROGSET executes the main dialog box.

shown in Figure 1. Its Add, Modify, Remove, and Exit buttons can be selected either by clicking with a mouse or by typing the Alt-letter combination for the desired button. The two radio buttons in the box at the top of the window control whether the list box displays file associations or pro-

grams that have installed themselves in your WIN.INI file. You can move through the list box either with the mouse or with the Up and Down Arrow keys. Alternatively, by typing its first letter you can advance automatically to the first item in the list box that begins with that letter.

PC MAGAZINE UTILITIES UPDATES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. The only way to obtain the modified versions is to download them from PC MagNet. Here is a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

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MONO.COM, Version 1.1
MOUSE.CTL, Version 1.1
PANDORA.COM, Version 1.5a
PCACCESS.COM, Version 1.1
PCMANAGE.EXE, Version 1.1
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RN.COM, Version 2.0
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SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
TPFST-AT.COM, Version 1.1

ZCOPY.COM, Version 1.2

For a full list of the programs available from the PC MagNet Utilities Database, download UDCAT.ARC.

A downloadable index to *PC Magazine's* product reviews is also available. PCM.EXE is a self-extracting file that contains the *Computer Library PC Magazine Reviews Index* for January 1988 to June 1990. It requires the search files in PCSRCH.EXE. Please read the information file PCM.INF before you download any of these files.

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Utilities

PROGSET will *always* ask for confirmation before it removes anything from WIN.INI, so you can feel free to experiment without actually deleting anything from your WIN.INI file. You can Add, Modify, or Remove file associations, and you can Remove installed programs.

To edit the file associations in WIN.INI, begin by selecting the File Associations mode with the appropriate radio button. Both the Modify and Remove functions act on the currently selected file association from the list box. When you choose Add or Modify, another dialog box will appear that provides fields for the file extension and the command line, together with OK, Cancel, and Browse buttons. With Add, you enter both the file extension and the command line; for Modify you simply enter or modify the command line. In either case, you can choose the Browse button to help you locate the file to be associated with the extension.

The Browse function works like a File Open dialog box: You select different drives and directories until you locate the desired file and then you either double-click the file or select OK. If you choose to enter the command line manually, you must remember to follow the [Associations] section format

```
ext = appname.exe ^.ext
```

discussed previously. If you use the Browse function, the proper default command line parameter is inserted for you. To remove a file association just click Remove and select Yes when PROGSET asks you to confirm your intention.

To remove (or uninstall) a program from WIN.INI, simply select the Installed Programs mode with the appropriate button from the top section of the PROGSET window. Then pick out the desired program from the list box and hit the Remove button. PROGSET will again ask if you really want to remove the section that you have selected. Click Yes and it's gone. Remember, however, that when you remove an installed program with PROGSET, you aren't actually deleting its files, but only removing the program's section from your WIN.INI file.

Because PROGSET is a fairly simple application, there is no need for a main application menu. For this reason, the

"About . . ." function is located in the system menu. You can access the system menu by clicking the little box in the upper-left corner of the PROGSET window or by typing Alt-Spacebar. (The picture in the system menu box represents a Spacebar, making the Alt-Spacebar combination easy to remember.) To exit PROGSET, all you have to do is click on the Exit button or type Alt-X.

INSIDE PROGSET

Programmers will be interested in several of the techniques embodied in PROGSET. As you can see from part of the source code shown in Figure 2, the main window loop is conspicuously missing and the WinMain function is rather sparse. This is not an accident, but a very slick programming method that I picked up from an unfortunately forgotten donor. Since PROGSET's main window is a dialog box, you simply execute the dialog box with a NULL where its parent window handle

would usually be found.

Microsoft's own publications go into great detail explaining other, more complicated ways of setting up a main window loop when your main window is a dialog box. What they seem not to have realized is that if the parent window handle is NULL, Windows does all the work necessary for a dialog box that is also the application's main window. This method is perfect for simple utilities like PROGSET.

In examining Figure 3 you will also notice a new function called DoDialog, which executes the main dialog box. DoDialog accepts many of the same parameters as the DialogBox routines: hInst, lpResName, hWnd, lpProc, and dwInitParam. I use this function in *all* my commercial programs. It eliminates the need both for coding the MakeProcInstance and FreeProcInstance calls and for allocating a variable to hold the MakeProcInstance return value every time you execute a dialog. It also eliminates the need to

DEFAULTDLG FUNCTION

```
.....
*
* FUNCTION: DefaultDlg(HWND, unsigned, WORD, LONG)
*
* PURPOSE: Default dialog procedure. Processes "OK" and "Cancel"
*           messages, and WM_CLOSE from SYSMENU.
*
* MESSAGES:
*
* WM_INITDIALOG - Initialize dialog box
* WM_CLOSE      - Close dialog from sysmenu
* WM_COMMAND    - Input received (IDOK or IDCANCEL)
*
*...../
int FAR PASCAL DefaultDlg(hDlg, message, wParam, lParam)
HWND hDlg;
unsigned message;
WORD wParam;
LONG lParam;
{
    switch (message)
    {
        case WM_INITDIALOG:
            return (TRUE);

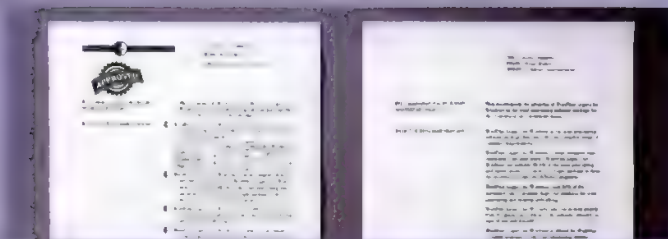
        case WM_CLOSE:
            SendMessage (hDlg, WM_COMMAND, IDCANCEL, NULL);
            return (TRUE);

        case WM_COMMAND:
            if (wParam == IDOK)
            {
                EndDialog(hDlg, IDOK);
                return(TRUE);
            }
            else if (wParam == IDCANCEL)
            {
                EndDialog(hDlg, IDCANCEL);
                return (TRUE);
            }
            break;
    }
    return (FALSE);
}
```

Figure 4: By calling DoDialog without supplying a procedure name, it uses the DefaultDlg function—also useful in prototyping.

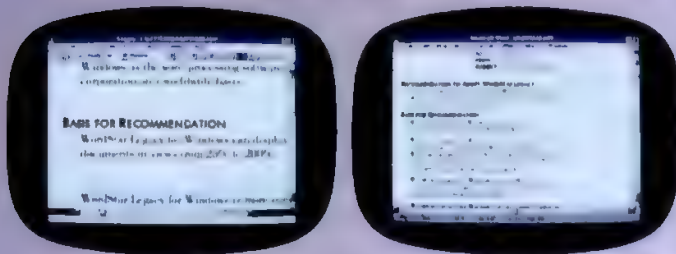
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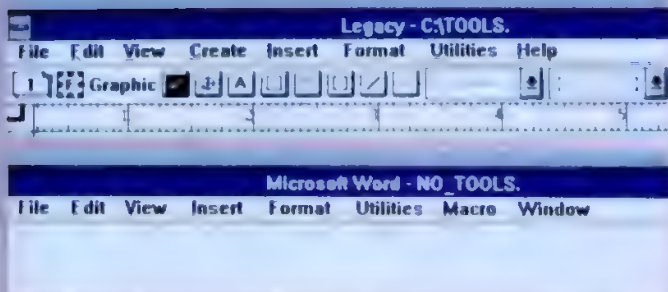
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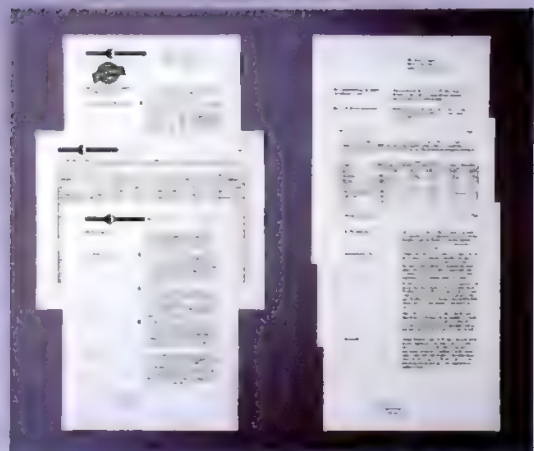
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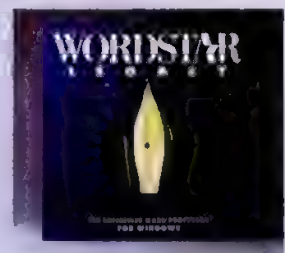
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Utilities

use either `DialogBox` or `DialogBoxParam`.

If you supply `DoDialog` with a `NULL` value for `dwInitParam` it calls `DialogBox`; otherwise it calls `DialogBoxParam` with the supplied parameter. Using `DialogBoxParam` causes *Windows* to send the `dwInitParam` in the `lParam` of the `WM_INITDIALOG` message. This method is often better than using global variables to communicate with a dialog box at start-up. If you want to pass more information than will fit in a `DWORD` variable, you simply make the `dwInitParam` a pointer to a structure that contains the desired data. If you pass a pointer to a structure, your dialog procedure can even change the data in the structure if a complex return type is needed.

`DoDialog` also serves as a valuable prototyping tool. If you don't supply a procedure name when you call `DoDialog`, it uses one called `DefaultDlg`. `DefaultDlg`, shown in Figure 4, handles only the `Close`, `OK`, and `Cancel` messages. I usually have at least one dialog (the `About . . .` box) that

uses this default dialog procedure, so I leave this code in after development is finished.

When you are developing your program, first make all of your dialog boxes, then code your application so that it calls them using `DoDialog` with `NULL` for the last two parameters. You can then compile your prototype for examination. The dialogs won't do anything but display and close themselves, but you will have a working prototype after writing only one line of code for each dialog box. Then, as you write your dialog procedures, just start replacing the `NULL lpProc` parameter to `DoDialog` with the names of the custom dialog procedures, until you have all of their functions built in.

The `Browse` function in `PROGSET` should look somewhat familiar. `Browse` is nothing more than a `File Open`-type dialog box that simply returns a filename instead of opening a file.

The radio buttons that control the file extension selection are an added touch. They really make selecting files of specific types much quicker and easier. If you download the full source code, you'll find that all of the code for the `Browse` function

has been assembled in a separate source file called `PSBROWSE.C`, so you can easily port all or part of it to your own *Windows* application. You should even be able to make your own "standard" `File Open` dialog with only a few minor changes to the `Browse` functions.

Now that you know how the `WIN.INI` file works, the *Windows* Control Panel application will be no mystery. `Control Panel` is just an application (although a fairly sophisticated one) that reads and writes parameters in `WIN.INI`. You can now create your own programs to modify `WIN.INI` (or any other `.INI` for that matter) if you know the layout.

There are several parameters in `WIN.INI` that can't be set or modified from the *Windows* Control Panel; you can find these settings by checking the `WININI.TXT` files. You may want to add functions for these settings to `PROGSET` or even create your own program using `PROGSET` as a starting point. ■

Robert Dickinson is president of Deming Software, which specializes in programming custom Windows applications and consulting.

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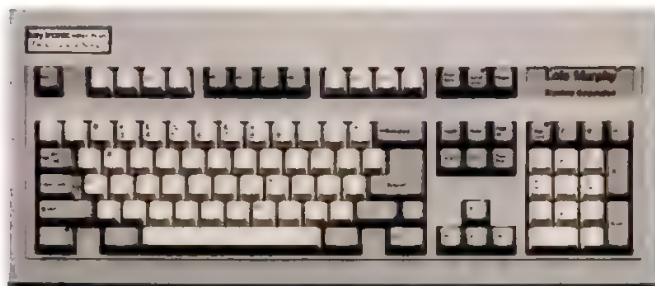
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PC MagNet News

The Latest Files and Features of PC Magazine's On-line Service

PC MagNet Under New ZiffNet Umbrella

As of April 1991, PC MagNet will be reorganized under a new main menu. From now on, ZiffNet will be the name for the on-line information service that will harbor each of the on-line counterparts of Ziff-Davis's PC-oriented family of publications (*PC Magazine*, *PC Week*, and now, *PC/Computing*).

Starting in May 1988, PC MagNet operated under the infrastructure of the CompuServe Information Service, and this relationship has not changed. What we have done is incorporated the advantages of each of the individual services under one roof. PC MagNet will retain its call name (GO PCMAGNET) and continue to serve with each of the four Interactive Forums (Editorial, Utilities/Tips, Programming, and After Hours) remaining the information-rich exchange centers that they have been. And the popular Editorial Forum will continue to house columnists Dvorak, Machrone, and Zachmann.

What will be added is a Utilities Database that will nearly double in size. The new Software and Utilities Library will include files and programs from all the Forum libraries under ZiffNet, including ASP Shareware, in addition to the *PC Magazine* utilities. We will also provide an expanded What's New? section, entitled This Week's Highlights, that will bring up-to-date *PC Magazine* information, as well as an industry news aspect to

the service from the folks at *PC Week*. ZiffNet's introduction coincides with the launch of *PC/Computing's* venture into the on-line world with *PC/Contact*, allowing *PC/Computing* readers to discuss various computer topics with its editorial staff.

One of the new features is our Buying Smarter section, in which you can search for *PC Magazine* reviews and access *Computer Library*. Another is our Using Smarter section, which adds *PC Week's* Forum and the *PC/Contact* Forum to help PC MagNet's UtilForum boost your productivity.

This is a major step toward providing *PC Magazine* readers and subscribers with the finest on-line companion to the printed page.

BROWSE Updated for VGA

Charles Petzold's classic BROWSE.COM utility, which originally appeared in *PC Magazine* way back in 1986 (March 25, 1986), has recently been updated for VGA and Super VGA monitors. This staple ASCII text file reader was designed before VGA came along, and would quit immediately, with an "unsupported video mode" message, if run on a system with the high-resolution card.

In an excellent example of the talent and adaptiveness of our PC MagNet users, Jerry Monroe has modified Petzold's all-but-essential utility to run in conjunction with the hi-res VGA and Super VGA cards. BROWSE.ZIP is located in DL 16, Gen Utils, of our UtilForum.

—Chris Parker

- **ZIFFNET ON-LINE:** PC MagNet continues to evolve, with the implementation of our ultimate on-line service.
- **BROWSE.ZIP:** Charles Petzold's classic utility has been updated to support higher-resolution VGA and Super VGA.

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by
Charles Petzold

Environments

When digital computers were first developed, the only type of data they could deal with was numbers. This isn't surprising. The impetus for developing computers resulted from a need for fast number-crunching, and numbers are easily represented with binary codes stored in computer memory. Storing text in computer memory was an easy step from there, requiring only an equivalence between text characters and the binary codes known as ASCII.

For too many computer users, text and numbers remain the only type of data their computers regularly handle. Yet, a world consisting of only text and numbers would be a very dull place indeed. The real world that we experience away from our desks and our PCs is a much more interesting place, full of visual images, both natural and man-made, and sound: voices, noise, and music.

What characterizes human beings is the sophistication of our communication among ourselves, and this involves a wide variety of formats—not only printed text and numbers, but vocal communication that includes inflections of voice, hand gestures, facial expressions, and general body language. The arts involve communication with visual images, sound, music, and voices. Over the past 40 years, television has become an increasingly important part of the global community, and the availability of inexpensive video cameras has brought this technology into the hands of individuals.

We have come to view the personal computer as an adjunct to our minds and our communicative needs. It is my belief that we need to extend the computer into realms beyond text and numbers. Computers should be capable of capturing, storing, processing, and rendering any type of data used in human communication.

BEYOND TEXT AND NUMBERS

Text and numbers are easy. Anything else is hard. The first level beyond text and numbers is obviously graphics, to make

Exploring Windows Bitmaps: How They Work, How to Use Them

■ A series of articles on *Windows* bitmaps begins with a look at bitmaps in general and at the device-independent bitmap file format.

possible the rendering of visual information on the computer screen. We have come to divide graphics into two main categories—*vector graphics* (generally involving human-defined images composed of lines, filled areas, and text) and *raster graphics* (where bitmaps represent the complexity of real-world images).

The step after graphics is sound, including music, and there are two different approaches to sound that are analogous to raster and vector graphics. We can capture real-world sounds through a microphone (or other audio source) and convert the sounds into digitized representations much like bitmaps. Or we can generate music through use of high-level commands that are similar to vector graphics; one common format is the Musical Instrument Digital Interface (MIDI). (See "Add a Musical Dimension to Your PC with MIDI," that appeared in the March 12, 1991 Lab Notes column, for a complete discussion of this interface.)

After sound is the integration of full-motion video into the computer, which involves (at first) dealing with video signals in the common NTSC (National Television Systems Committee) format used in

the U.S. for television, VCRs, and video cameras. Unfortunately, the word that describes using the computer in this way has become a buzzword almost as repugnant as *artificial intelligence* or *desktop publishing*. The word is *multimedia* and I'll try to avoid it as much as possible. For some reason, there seem to be a lot of people who think it would be neat to play music and watch TV images on their PCs but who don't want anything to do with this thing called multimedia!

Hardware for audio and video already exists, and it's likely to become more prevalent over the next few years. As with graphics, what we need is a device-independent interface so we can use such hardware without dealing with its peculiarities.

Microsoft has defined a set of multimedia extensions to *Windows* 3.0 that will probably be available later this year. These involve some improved support for bitmaps as well as device-independent APIs for digitized sound and MIDI. The possibilities are very exciting, and I intend to discuss these graphics and sound extensions in future installments of this column.

BEGINNING WITH THE BITMAP

For the immediate future, I'll be focusing on bitmaps, which will remain a very important component. I've been discussing the *Windows* 3.0 palette manager in the past several issues partly in preparation for this discussion. Because bitmaps are very often digital representations of real-world images and most video boards are not capable of simultaneously dis-

Environments

playing the full range of real-world color, manipulating the video palette is necessary for rendering these images accurately.

Throughout this series of articles on *Windows* bitmaps, I'll be showing components of a program called WINCAP, which captures areas of the *Windows* screen as bitmaps and converts bitmaps among various popular formats. I'll also include code in WINCAP to capture an image through a low-cost color scanner (the Sharp JX-100) and a video frame-grabber. This program will eventually be made available on PC MagNet.

SOME COMMON CHARACTERISTICS

The bitmap is a brute-force approach to storing graphics images. In a bitmap, the image is encoded as an array of bits that correspond to pixels on the surface of a graphics display. Bitmaps are almost always rectangular, and if the image itself is not rectangular, then the image must be rendered with a "mask" bitmap that defines the shape of the image, or some bits of the bitmap must be interpreted as "transparent" colors.

The bulk of a bitmap is, of course, the bits themselves, but some header information is necessary to define how the bits are interpreted. This includes the height and width of the bitmap (expressed in number of pixels) and color information. In a monochrome bitmap, 1 bit in the bitmap corresponds to one pixel on the display. A color bitmap requires multiple bits per pixel. In this case, the header information should describe how these multiple bits correspond to particular colors.

There are many file formats for storing bitmaps under DOS. One de facto standard is ZSoft's *PC Paintbrush* format with the file extension .PCX. Many bitmaps are available on CompuServe with the extension .GIF (Graphics Interchange Format). Perhaps the most sophisticated bitmap format is TIFF (tagged-image file format). *Windows* (and OS/2 Presentation Manager) bitmap files have an extension of .BMP.

WHERE DO BITMAPS COME FROM?

Because bitmaps are often used to store real-world images, they usually enter the computer through a scanner or a video frame grabber. A scanner can convert a photographic image into bitmapped data;

a frame grabber can convert a video signal (from a video camera or VCR, for example) to bitmapped data. Bitmaps can also be created by hand, using paint programs. The *Windows* Paintbrush program (which was created by ZSoft) can save painted images in either the .PCX or .BMP formats. The *Windows* Software Development Kit includes a program called SDK Paint that programmers can use to create small bitmaps, icons, or cursors. Icons and cursors are basically bitmaps.

A *Windows* program can create a bitmap and draw on it using GDI drawing func-

business use bitmaps to capture graphics screen images for reproduction in the magazine. Here at *PC Magazine*, we use the .PCX file format for the job.

Many *Windows* users enjoy using bitmaps as "wallpaper" to decorate the back of the *Windows* screen. This wallpaper can contain images of loved ones or industry leaders, for example.

THE WINDOWS BITMAP

In *Microsoft Windows* 3.0, the bitmap is one of six "objects" supported under the *Windows* Graphics Device Interface (GDI). The other five objects are *pens* (used for drawing lines), *brushes* (for filling areas), *fonts* (for drawing text), *regions* (for drawing or clipping), and *palettes*, which I've discussed over the past few issues.

Bitmaps supported under earlier versions of *Windows* are now often called "device-specific bitmaps." *Windows* 3.0 includes an enhancement to the earlier *Windows* API in the form of the *device-independent bitmap* or DIB. Unfortunately, *device-independent bitmap* is a misnomer, and this contributes to much of the confusion about *Windows* 3.0 bitmaps.

The device-independent bitmap includes a simple run-length encoded (RLE) compression scheme that itself includes a way to define only parts of a bitmap image. It turns out that this can be very efficient for animation sequences or digitized video. This is another subject I'll discuss in the future.

It's probably best to speak of *Windows* bitmaps in three ways: as files, as specifications, and as GDI objects. A bitmap *file* is stored on a disk with the extension .BMP. Although Microsoft never publicized the old pre-*Windows* 3.0 device-specific bitmap file format, it was easy enough for many people to figure out. In contrast, the device-independent bitmap file format is well documented.

The bitmap is a brute-force approach to storing graphics images. In a bitmap, the image is encoded as an array of bits that correspond to pixels on the surface of a graphics display.

tions, then copy the bitmap to the program's window. In some cases, this allows the program to refresh its window faster than would otherwise be possible. A bitmap used in this way is sometimes called a shadow bitmap.

A program can also copy images from the *Windows* screen to a bitmap. Those of us in the personal computer magazine

THE BITMAPFILEHEADER STRUCTURE

```
typedef struct tagBITMAPFILEHEADER
{
    WORD    bftype ;           // "BM" or 0x4D42
    DWORD   bfsize ;          // Size of the file in bytes
    WORD    bfReserved1 ;     // Set to 0
    WORD    bfReserved2 ;     // Set to 0
    DWORD   bfoffBits ;       // Offset in file where
                                // the bits begin
}
BITMAPFILEHEADER ;
```

Figure 1: This BITMAPFILEHEADER structure consists of 14-bytes and appears at the beginning of a device-independent bitmap file.

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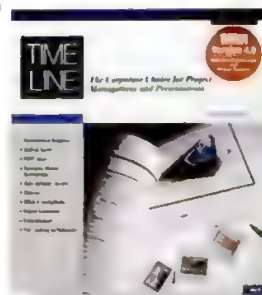


Time Line 4.0 received PC World's 1990 World Class Award, and was a recommended product by InfoWorld in April 1990.

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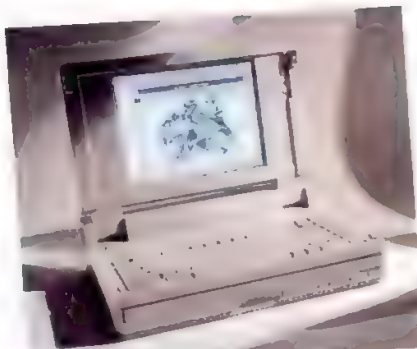
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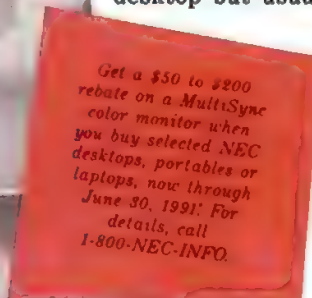
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Environments

A *bitmap specification* consists of essentially the same information found in a bitmap file, but stored in application memory. Again, bitmap specifications can exist in the device-specific and device-independent formats.

A *bitmap object* is stored in memory managed by the *Windows* GDI module and is referenced by a handle to the bitmap. In *Windows* 3.0, there is no such thing as a device-independent bitmap object. All bitmap objects are device-specific. This is not generally understood, partly because *Windows* 3.0 contains a function named *CreateDIBitmap* that creates a bitmap object and returns a handle to the bitmap. It sure sounds like *CreateDIBitmap* creates a device-independent bitmap, but it doesn't. Read the description of the function in the *Microsoft Windows Programmer's Reference*: "This function creates a device-specific memory bitmap from a device-independent bitmap (DIB) specification and optionally sets bits in the bitmap."

At any rate, the relationship between device-independent bitmaps and device-specific bitmaps will become clearer (I hope!) in subsequent columns when I discuss bitmap creation and bit format in more detail.

PROBLEMS

Bitmaps have two problems that affect device-independence. The first is the bitmap size. A 300-by-300-pixel bitmap occupies more than a quarter of a VGA screen but only a 1-inch square area on a laser printer. If it's necessary to display the image in a bitmap in a particular size, there are two fields in the *Windows* 3.0 device-independent bitmap file that can indicate a resolution of the bitmap in pixels per meter. This information can assist programs in stretching or compressing the bitmap.

The more difficult problem is color. Bitmaps are often derived from real-world images that may contain thousands of different colors. Most video boards in use today can't handle the simultaneous display of more than 16 or 256 colors. Thus, rendering the image on a video display requires some color approximations.

Even if the bitmap uses only 16 colors and will be displayed on a VGA, it may not necessarily require the same 16 colors that *Windows* defines for the VGA

palette. Again, color approximation is required.

For many types of image, color approximation is not a big deal. But not surprisingly, as human beings, we require color to be most accurate when we see images of other human beings. We know when a person's face is rendered too green or too red or too saturated or too gray. I think almost everyone—from dedicated

The big difference between the old device-specific bitmap and the new device-independent bitmap is that the latter contains information about color.

TV couch potatoes to professional cinematographers—uses flesh tones as the true test of color accuracy. It's almost impossible to adjust the controls correctly on your TV set unless you see someone's face on the screen.

The problems with color bitmaps, limited video boards, and flesh tones were succinctly summed up by a friend of mine (who is fond of displaying GIF files on his PC) with the observation: "Christie Brinkley is not gray." However, with the *Windows* 3.0 palette manager, a 256-color

bitmap *can* accurately be displayed on a Super VGA or 8514/A video board. We'll see how this is accomplished in a future installment.

Printers have their own problems with bitmaps. Most printers can't display color at all, so the bitmap must be converted to black-and-white or (in some cases) gray shades. And forget about displaying bitmaps on plotters.

The big difference between the old (pre-*Windows* 3.0) device-specific bitmap and the new device-independent bitmap is that the device-independent bitmap contains information about color. It may seem like the inclusion of color information is necessary in a bitmap, but (as we'll see in the next issue) device-specific bitmaps got along without it.

THE DIB FILE FORMAT

Let's begin our exploration of *Windows* bitmaps by looking at the device-independent bitmap file format. I actually discussed this several months ago, but a quick review should be helpful.

A DIB file has four main parts: a file header, an information header, an RGB color table, and the bits themselves.

The file begins with 14 bytes defined by a structure, of type *BITMAPFILEHEADER*, as shown in Figure 1. This is fairly self-explanatory. The file begins with a two-character abbreviation for bitmap. The two reserved fields are used in mouse cursor files to define the "hot spot" of the cursor.

The *BITMAPFILEHEADER* structure is followed by a *BITMAPINFOHEADER* structure (for a *Windows* 3.0 DIB file) or a *BITMAPCOREHEADER* structure (for an OS/2 1.x bitmap file). These two structures are shown in Figures 2 and 3.

Here's where it gets a little compli-

THE BITMAPINFOHEADER STRUCTURE

```
typedef struct tagBITMAPINFOHEADER
{
    DWORD    biSize;           // Size of the structure
    DWORD    biWidth;          // Width in pixels
    DWORD    biHeight;         // Height in pixels
    WORD     biPlanes;         // Set to 1
    WORD     biBitCount;       // Color bits per pixel
    DWORD    biCompression;    // Compression scheme
    DWORD    biSizeImage;      // Number of bitmap bytes
    DWORD    biXPelsPerMeter;   // Horizontal resolution
    DWORD    biYPelsPerMeter;   // Vertical resolution
    DWORD    biClrUsed;        // Number of colors used
    DWORD    biClrImportant;    // Important colors
}
    BITMAPINFOHEADER ;
```

Figure 2: This structure follows the *BITMAPFILEHEADER* structure in a DIB file.

Environments

THE BITMAPCOREHEADER STRUCTURE

```
typedef struct tagBITMAPCOREHEADER
{
    DWORD bcSize;          // Size of the structure
    WORD  bcWidth;         // Width in pixels
    WORD  bcHeight;        // Height in pixels
    WORD  bcPlanes;        // Set to 1
    WORD  bcBitCount;      // Color bits per pixel
}
    BITMAPCOREHEADER ;
```

Figure 3: In an OS/2 1.x bitmap file, this is the information structure that appears after the BITMAPFILEHEADER structure.

cated if you're writing code to read *Windows* bitmap files. You probably want to write this code to read OS/2 bitmap files also. You can determine the type of bitmap you're dealing with by the size of the structure that follows the BITMAPFILEHEADER structure.

If the DWORD value that follows the BITMAPFILEHEADER structure is 12 (decimal), you're dealing with an OS/2 bitmap file and you should use the BITMAPCOREHEADER structure for reading the information. In a *Windows* bitmap file, the structure may be cut off anytime after the **biBitCount** field, so the size of the structure will be 16 or larger. (The OS/2 2.0 bitmap file format is the same as that in *Windows* 3.0, except more fields are defined in the OS/2 2.0 information structure.) If the size of the structure is lower than 12, or if it's 13, 14, or 15, you're dealing with a corrupted bitmap file.

The **biBitCount** or **bcBitCount** field indicates the number of color bits per pixel and can be set to either 1, 4, 8, or 24. These correspond to 2-color (monochrome), 16-color, 256-color, or full 24-bit RGB color bitmaps.

The **biCompression** and **biSizeImage** fields are used for bitmap compression, which I'll discuss in a later installment of this column. For uncompressed bitmaps, these fields are set to 0.

The **biXPelsPerMeter** and **biYPelsPerMeter** fields indicate a suggested resolution of the bitmap image in pixels per meter. These fields can be set to 0 to indicate no specific resolution.

I'll skip the two last fields for the moment. An array of RGB color values follows the BITMAPINFOHEADER structure. These are RGBQUAD values for *Windows* 3.0 device-independent bitmaps, and RGBTRIPLE values for

OS/2 1.x compatible bitmaps:

```
typedef struct tagRGBQUAD
{
    BYTE rgbBlue ;
    BYTE rgbGreen ;
    BYTE rgbRed ;
    BYTE rgbReserved ; // set to 0
}
    RGBQUAD ;
```

```
typedef struct tagRGBTRIPLE
{
    BYTE rgbtBlue ;
    BYTE rgbtGreen ;
    BYTE rgbtRed ;
}
    RGBTRIPLE ;
```

There are 2 RGB values for 1-bit-per-pixel bitmaps, up to 16 RGB values for 4-bit-per-pixel bitmaps, and up to 256 RGB values for 8-bit-per-pixel bitmaps. The RGB table is absent for 24-bit-per-pixel bitmaps.

The RGB color table should be set up so that the most important colors are at the beginning. This is because some programs may perform palette manipulation using the color table, and the palette functions give priority to the RGB values at the beginning of the table.

The bitmap data follows the RGB color table, organized by rows of pixels beginning with the bottom row and proceeding up. Each row begins with the leftmost pixels and is possibly padded to the right so the row has a multiple of 4 bytes.

For 1-bit-per-pixel bitmaps, each byte corresponds to 8 pixels. The leftmost pixel is the most significant bit of the first byte. A 0 bit represents a pixel color given by the first entry in the RGB color table and a 1 bit represents a pixel color given by the second entry.

For a 4-bit-per-pixel bitmap, each byte corresponds to 2 pixels. The leftmost pixel is the high 4-bits of the first byte. The value of each 4-bit pixel ranges from 0 to 15. GDI uses this value as an index into the 16 entries in the color table to obtain the color of the pixel.

For an 8-bit-per-pixel bitmap, each byte is one pixel. The value of the byte can range from 0 to 255. This is an index into the 256 entries in the color table.

For a 24-bit per pixel bitmap, each pixel requires 3 bytes for the red, green, and blue color values. Each row of bitmap data is basically an array of RGBTRIPLE structures, possibly padded at the end of the row so that the row has a multiple of 4 bytes.

Normally, the **biClrUsed** field in the BITMAPINFOHEADER structure is set to 0. However, it could be that a 4-bit (or 8-bit) per pixel bitmap requires fewer than 16 (or 256) colors. In these cases, it is possible for the bitmap to have a shorter color table. The number of actual entries in the color table is then given by the **biClrUsed** field in the BITMAPINFOHEADER structure.

Set up the RGB color table so that the most important colors are at the beginning—palette functions give priority to values at the beginning of the table.

Finally, the **biClrImportant** field indicates the number of colors in the color table that are considered important for rendering the image. This could be a "hint" for a program that uses the bitmap to determine whether it can accurately display the bitmap or not. Normally this field is set to 0.

STAY TUNED

In the next issue, we'll examine the various bitmap creation functions, and establish that *CreateDIBitmap* does not create a device-independent bitmap. ■



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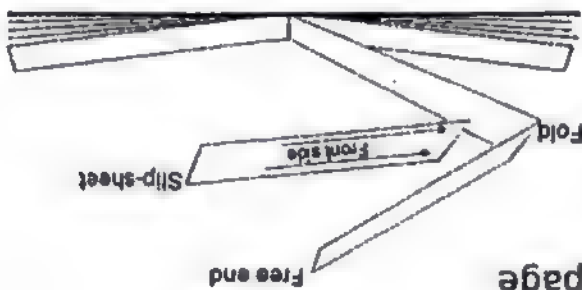
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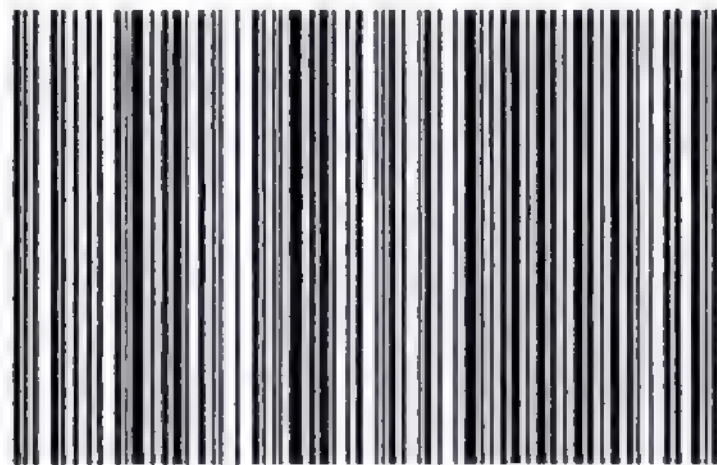
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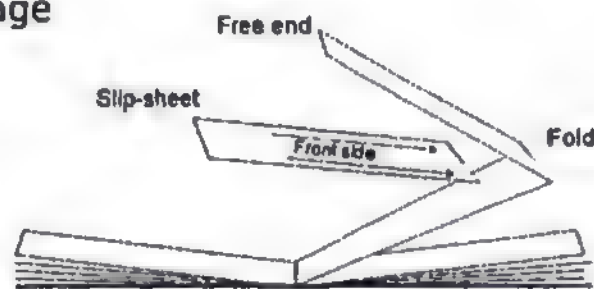


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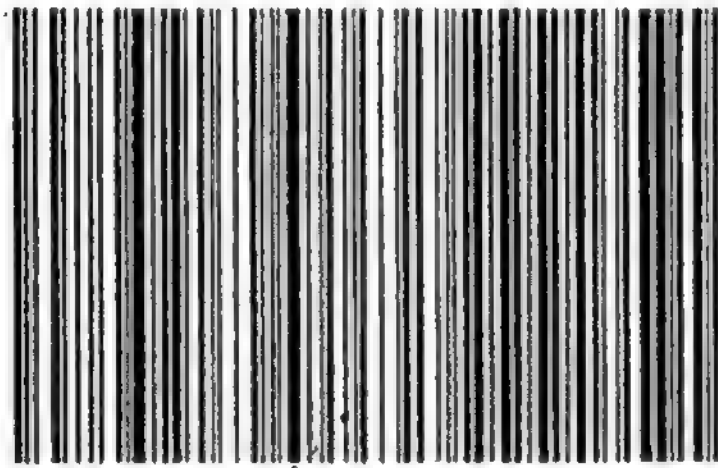
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by
Ray Duncan

Power Programming

Containers and Objects: Object Linking and Embedding in Windows

Although you might think *Microsoft Windows* would be an ideal environment for complex suites of interdependent applications, given its multitasking and virtual memory capabilities, the interprocess-communications (IPC) facilities in *Windows* have been slow in evolving. In fact, *Windows* 1.0 had no standardized IPC facilities other than the system clipboard, and the dynamic data exchange (DDE) protocol that was defined in *Windows* 2.0 was cobbled together out of global atoms, global data segments, and a few special-purpose *Windows* messages. As we saw in the last two installments of this column, DDE is certainly better than nothing, but it is a fragile and complex mechanism, and it requires skill, experience, and a generous measure of good luck on the part of the programmer.

Nevertheless, you might be surprised to learn that *Windows*' track record for IPC, when compared with that of a far more elegant GUI environment—the Macintosh System—is really quite good. Even today, in Macintosh System 6.0.7, the only provision for transferring data from one application to another is the clipboard, and the clipboard would be extremely painful to use if not for the relatively recent addition of a simple task switcher (MultiFinder) that allows you to keep more than one program in memory at once. There is no Mac equivalent to a DDE-based hot link; all transports of data are passive and static, relying entirely on user intervention.

In 1989 and 1990, significant pressure was placed on Microsoft to make *Windows* into a better platform for the synergistic use of multiple applications. This pressure came from two directions. First, Hewlett-Packard released *HP NewWave Environment*, an object-oriented user and application interface that is layered on top of *Windows*. *NewWave* allows text and graphics produced by multiple applications to be combined in a natural manner. It also introduces the concept of *agents*—the first step toward user inter-

■ A new protocol for the construction of compound documents, OLE is built upon DDE but represents the relationships among document components at a much higher level.

faces that “do what I mean, not what I say.” Although the critics loved *NewWave*, it has been slow to find acceptance among users; this results partially from its price, partially from its demand for system resources, and partially (I suspect) from its status as a proprietary product of a PC hardware vendor. *PC*

Magazine has reviewed *NewWave* in detail, so I won't discuss it further here.

Second, during 1989, Apple released detailed information about System 7, the upcoming major overhaul of the Macintosh's operating system, and seeded its key developers with beta-test versions of the software in 1990. The capabilities of System 7 stand in approximately the same relationship to System 6 (the current version) as the capabilities of OS/2 do to DOS; we can only hope for the sake of Macintosh users that System 7 meets a kinder fate than OS/2 did! In any case, among the new features of System 7 is a multilevel IPC facility called the Apple Inter-Applications Architecture (IAC), which has four facets: program-to-program communication, Clipboard Copy-Paste, Live Copy-Paste, and AppleEvents.

Program-to-program communication

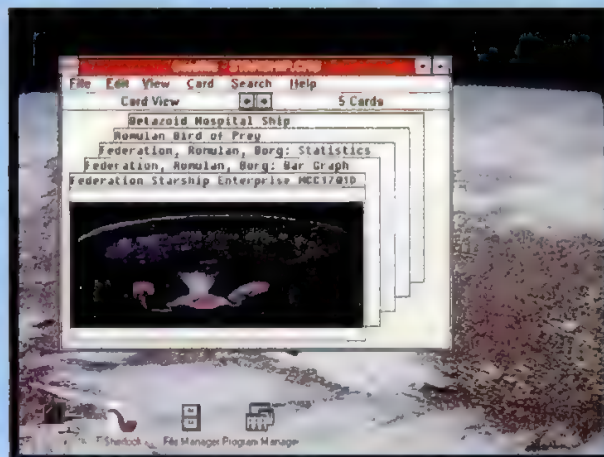


Figure 1: The first step in editing an embedded object. This shows an experimental OLE-aware version of Cardfile, which has loaded a Cardfile file containing several different embedded objects. The card at the front of the stack contains a picture that was pasted in from *Paintbrush*.

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in System 7 is roughly equivalent to the semaphores, pipes, and shared memory segments found in OS/2 or Unix; it allows raw data to be passed from one program to another but gives the programs no aid in interpreting the data. One important difference between System 7's program-to-program communication and the more traditional Unix or OS/2 mechanisms is that System 7 will support both real-time data transfer and store-and-forward communication. Clipboard Copy-Paste is the mechanism for transfer of text and bitmaps that has been available on the Mac from the beginning; it is essentially a passive operation from the application's point of view, but it does aid the application by imposing structure on the data.

System 7's Live Copy-Paste is conceptually similar to the DDE support in Windows and OS/2. It allows the data in worksheets, databases, documents, and other application constructs to be hot-linked so that a change made to one file will automatically be reflected in the others. The last of the new IAC facilities, AppleEvents, has the most long-term potential. AppleEvents are a standard set of messages that applications can use to request actions of one another, mimicking in some ways the messages sent to an application

when the user interacts with it via the screen and mouse. Among other things, AppleEvents will form the basis of a high-level macro language, allowing users to automate complex series of actions involving multiple application programs in an object-oriented manner.

Microsoft's own near-term plans for improving application integration under Windows are based on a protocol for the construction of *compound documents*—documents whose components are created in more than one application—called Object Linking and Embedding (OLE, sometimes pronounced like the Spanish word *Olé*). OLE was developed by Microsoft in collaboration with Lotus, Aldus, WordPerfect Corp., and others, and some degree of support for OLE is already present in Microsoft's latest Windows applications, PowerPoint and Excel 3.0. In this installment, we'll discuss OLE from several different perspectives: the user interface, the conceptual framework, and its implementation in Windows.

OLE AND THE USER

The capabilities of OLE are presented to the user via the standard Windows Copy, Cut, Paste, and Paste-Link operations. The user doesn't have to learn any new commands, and the behavior of these operations remains unchanged across non-OLE applications, or between non-OLE and OLE applications. However, when data is Copied (or Cut) in one OLE-aware ap-

plication and then Pasted or Paste-Linked into another OLE-aware application, the user finds that his working environment has suddenly become a lot richer. Let's look at the Paste and Paste-Link cases individually, using Excel 3.0 and the OLE-modified versions of Paintbrush and Cardfile that were distributed at the recent Software Development '91 conference.

Pasted data actually resides in the document or other file into which it has been pasted; the original Copied data is physically distinct from the Pasted data, and when you change the data that was

With OLE, pasted data has the ability to "remember" which application created it.

Copied, the Pasted data will not be automatically updated to match it. The new feature that OLE brings to the party is the ability of the Pasted data to "remember" which application created it, and to transparently invoke that application for editing and presentation of the Pasted data. Figure 1 shows a small Cardfile document containing different text chunks,

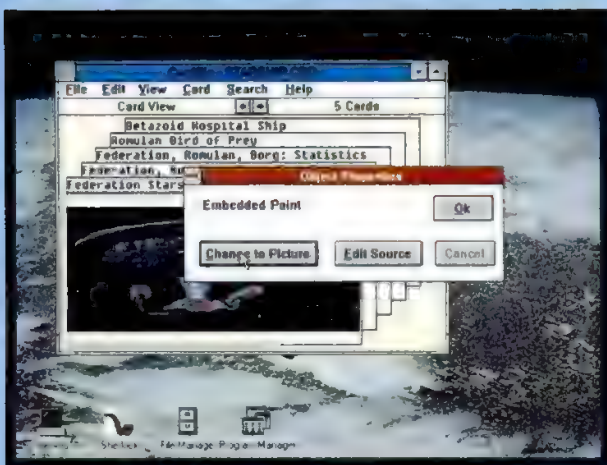


Figure 2: In order to edit the embedded picture, you first click on the picture to select it, then choose the Properties item on Cardfile's Edit menu, which results in the dialog box shown here. To invoke the application that owns the embedded object, you click on the Edit Source button.

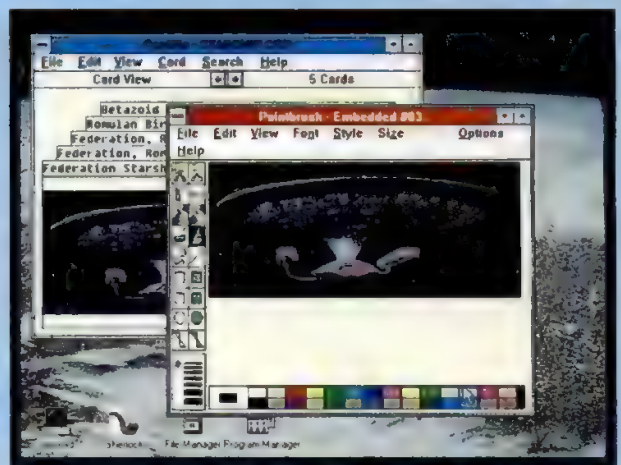


Figure 3: The OLE libraries looked up the class information for the embedded object in the system registry, determined that this particular object was created by Paintbrush, and loaded Paintbrush as an OLE "slave" to edit the picture.

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graphs, tables, and images on separate cards. The top card contains a bitmapped picture of a famous starship that was Pasted in from Paintbrush. If I click on the bitmap within the card and then select Properties from Cardfile's Edit menu, I am presented with a dialog box that gives me several options (see Figure 2). I can dismiss the dialog without doing anything (the OK button), I can throw away the OLE information associated with the bitmap, transforming the bitmap into static data within the Cardfile forever (the Change to Picture button), or I can invoke the application that knows how to understand and manipulate the bitmap (the Edit Source button).

Let's assume that I click on the Edit Source button. Cardfile continues running, but Paintbrush is loaded and becomes the active application, displaying a copy of the same bitmapped picture in its editing window (Figure 3). (Note Paintbrush's title bar, which indicates that it is running as a "slave" of another OLE application.) I am now free to make any changes that I like to the bitmap, using the usual Paintbrush tools, but the bitmap displayed in the Cardfile window doesn't reflect these changes as I make them. When it's time to leave Paintbrush, I pull down the File menu as usual and find

some unfamiliar possibilities there (Figure 4): Update, Save Copy As, and Exit and Return. If I select Update, the (possibly modified) bitmap is stored back into the Cardfile card whence it came, overwriting the previous bitmap; the Save Copy As command allows me to write the bitmap into a file of its own, without any effect on the Cardfile card's bitmap; and the Exit and Return menu item closes Paintbrush down, making Cardfile the active application once again. Of course, I can also switch back and forth between Cardfile and Paintbrush at any time while both are running, by clicking on the appropriate window or by bringing up the Program Manager's Task List.

OLE Paste-Linked data, unlike Pasted data, is conceived of as existing in just one place in the system—the document or other file within which it was originally created. The document that the data is Paste-Linked into contains a bundle of pointers at the point of the data's insertion: the name of the application that created the data, the name of the file containing the data, and some coordinates or other values that define and delimit the Paste-Linked data within the original file. Before OLE, you could only modify Paste-Linked data if you were in possession of the appropriate "magical" information: you had to explicitly load the application that created the data, open the file that contained the data, make your changes, and then the file where the data was Paste-

Linked would also be updated via DDE to reflect those changes. When applications are OLE-aware, nearly all of this hassle disappears.

Let's look at a real example of OLE Paste-Linking. Using the same Cardfile file, I have now brought a card to the front that contains a small table from an *Excel* 3.0 spreadsheet (Figure 5). When I click on the table and then invoke the Edit Properties command, I am presented with a much different dialog box (Figure 6) from the one we previously saw for Pasted data: This dialog allows me to choose between working on the original data (the Open Source button), forcing an update of the Cardfile card from the original document (the Update Now button), converting the Paste-Linked data into static data within the Cardfile card (the Cancel Link button), updating the Paste-Link information to reflect a change in the original file's name or location (the Change Link button), or dismissing the dialog (the Close button).

For this example, I click on the Open Source button. *Excel* is activated, and it automatically loads the spreadsheet from which the data was Paste-Linked into Cardfile. Any changes that I make in the spreadsheet window are immediately visible in the Cardfile window as well (Figure 7). This makes sense, because our mental model of Paste-Linked data is that there is really only one copy of it around. When I pull down the File menu of *Excel*, I

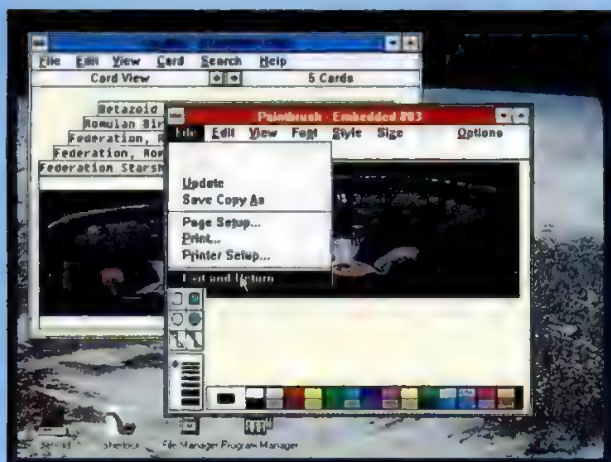


Figure 4: When Paintbrush is loaded to edit an embedded or linked object, it is passed a special command line switch that causes it to change its File menu and to respond to commands that are passed via the OLE libraries, as well as to direct interactions with the user.

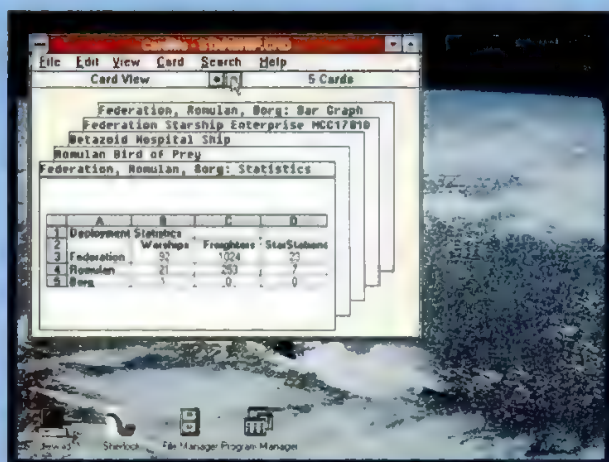


Figure 5: The first step in editing a linked object. Using the same OLE-aware version of Cardfile and the same demonstration file containing embedded and linked objects, we have now brought a card to the front that contains a table that was Paste-Linked in from an *Excel* 3.0 spreadsheet.

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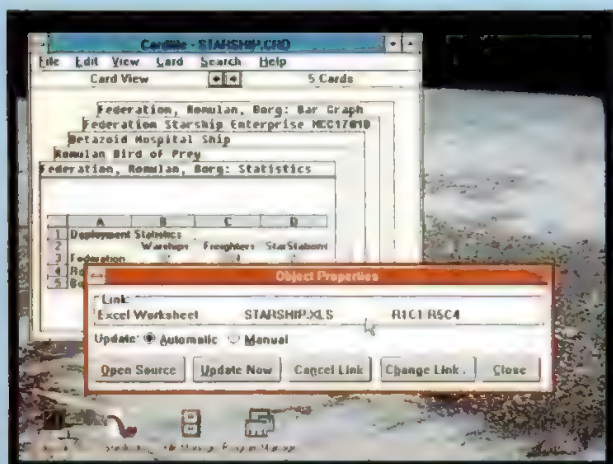


Figure 6: After clicking on the linked table and invoking the Properties item in Cardfile's Edit menu, you see a very different dialog box than the one used for an embedded object. This dialog box lets you choose between working on the original data, forcing an update of the Cardfile card, converting the Paste-Linked data into static data, updating the Paste-Linked information, or dismissing the dialog. To work on the data in the table, you click on the Open Source button.

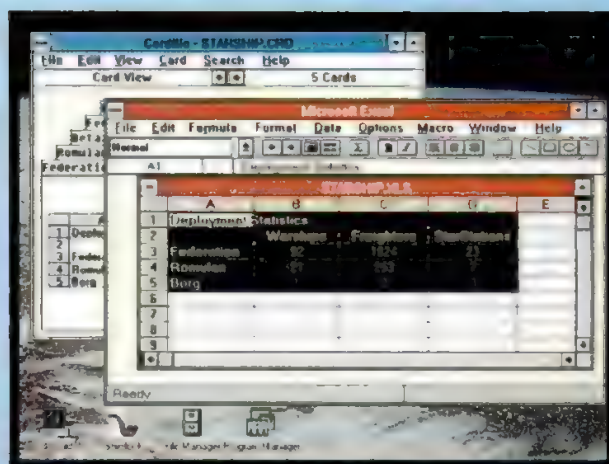


Figure 7: The OLE libraries have activated Excel, which has in turn loaded the original spreadsheet for editing. Changes made to the spreadsheet are reflected immediately in the Cardfile window as well. However, if Excel is exited without saving the modified spreadsheet, the table in the Cardfile card will revert to its previous state. This is because the data exists in only one place, and both the Cardfile and Excel presentations are simply different viewports onto the same data.

don't find anything new or OLE-related—just the usual Save, Save As, and Exit commands. If I save the changes and exit from Excel, Cardfile comes to the foreground again, and the card containing the spreadsheet data is visible with the updated information; if I terminate Excel or close the spreadsheet without saving the changes, the data in the Cardfile card reverts to the previous values.

OLE TERMS AND CONCEPTS

OLE is based on a very simple conceptual model, summarized in the OLE specification with the statement: "There are things and there are places that those things can reside." The two fundamental components of OLE are *containers* and *objects*. A container is anything that can receive and hold objects or links to objects. An object is a more complex entity: it has *content* (that is, unique data), *behavior* (a valid set of operations that can be performed on the data), and a *presentation* (the appearance of the object within its container). The *owner* of an object is the application that created it, regardless of where the object may end up.

The prototype of a container is a file—a named collection of bytes on a disk—but the concept of a container can be taken

much further. It's quite reasonable, for example, to regard a Cardfile file as a nested set of containers: The file contains a collection of cards, each of which can be thought of as an object, but a single card is also a container, because it can hold objects created in and native to Cardfile (the card's title) and objects pasted in from somewhere else (text or bitmaps in the card's body). Similarly, the Windows desktop can be thought of as a sort of cosmic container that encompasses all the objects in the system.

There are three atomic operations that can be performed on objects in the OLE schema: move, copy, and link. Each operation has a source container and a destination container. When an object is *moved*, it is physically transferred from one container to another (or one position within a container to another in the same container) without leaving anything behind. When an object is *copied*, the object is duplicated and one object is deposited at the destination while an identical object remains behind at the source. When an object is *linked*, it remains unchanged at the source location, but information describing the source and owner of the object is placed at the destination.

The critical aspect of compound docu-

ments (containers) built up of objects or links to objects is that the application controlling the container doesn't need to understand the objects. When an embedded or linked object is manipulated in any way other than to simply move it around, it is operated on by the tools in the application that originally created it—not by the container's application. In effect, a container just sends generic messages to an object ("edit yourself," "display yourself," "print yourself"), and the object's "methods" for handling these messages reside in its owner application. If an object's association with its methods is stripped away, it is no longer an object but simply pasted data, and the responsibility for editing and presenting the data reverts to the container's application.

An alternative, less object-oriented way to look at OLE is that it is yet another variation on *client-server* computing. The application that controls the container is the client, and it requests various kinds of editing and presentation (rendering) services from the servers associated with the objects in the container.

THE PROGRAMMER'S VIEW OF OLE

OLE is realized in Windows using the systemwide registration facility, several

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PC MAGAZINE	CLIENT ECD FUNCTIONS
Document management functions	
EcdRegisterClientDoc	
EcdReleaseClientDoc	
EcdRenameClientDoc	
EcdRevertClientDoc	
EcdSavedClientDoc	
Clipboard handling functions	
EcdCopyToClipboard	
EcdCreateFromClip	
EcdCreateLinkFromClip	
EcdCutToClipboard	
EcdQueryCreateFromClip	
EcdQueryLinkFromClip	
Object file I/O functions	
EcdLoadFromStream	
EcdSaveFromStream	
Object creation functions	
EcdClone	
EcdCopyFromLink	
EcdCreate	
EcdCreateFromFile	
EcdCreateFromTemplate	
EcdCreateLinkFromFile	
EcdEqual	
EcdObjectConvert	
Object management functions	
EcdClose	
EcdDelete	
EcdDraw	
EcdEnumObjectFormats	
EcdGetData	
EcdGetLinkUpdateOptions	
EcdOpen	
EcdQueryBounds	
EcdQueryOpen	
EcdQueryOutOfDate	
EcdQueryProtocol	
EcdQueryReleaseMethod	
EcdQueryReleaseStatus	
EcdReconnect	
EcdRelease	
EcdSetBounds	
EcdSetData	
EcdSetHostNames	
EcdSetLinkUpdateOptions	
EcdSetTargetDevice	
EcdUpdate	

Figure 8: The Client ECD functions defined by Microsoft for Object Linking and Embedding. The entry points to these functions are found in a client DLL.

new clipboard data formats, and a new API that supports and defines the communication between clients and servers.

When an OLE application is installed, it makes its presence known to other OLE applications via the generic *Windows* registration facility. (This facility is a small indexed database and a set of functions that allow information to be added, queried, or deleted from the database.) There

are four crucial pieces of information placed in the system registry by each application that is capable of acting as an OLE server: the class name for the objects that it knows how to handle (often derived from the name of the application), a human-readable and more descriptive version of the class name, the exact name of the application's executable file, and the name of the application's OLE server DLL (more about this presently).

The new clipboard data formats allow an OLE-aware application to communicate objects to other OLE applications and still support the simpler, traditional Copy/Cut/Paste/Paste-Link operations as well. When the Copy command is used in an OLE application, the application first renders the data to the clipboard in the standard text, bitmap, and metafile formats that can be understood by "old" *Windows* programs. It then adds three more clipboard data formats that completely define the object. The first format is called *Native*; it is simply the object's data in the owner application's internal representation. The second format is called *OwnerLink*; this format contains the object's class name, which completely defines the object's behavior, because it can be used to look up the name of the server application for the object in the system registry. The third format is called *ObjectLink*; it describes the class of the object's source container, the filename of the container, and the limits of the object within the source container.

The API functions defined as the basis of OLE are numerous and complex. Each function name starts with Ecd (for *extensible compound document*), and the functions fall into two groups: functions called only by clients and functions called only by servers (Figures 8 and 9). The entry points to all the functions are located in dynamic link libraries (DLLs). As you can see from Figure 10, the code that does the work of OLE is distributed among five places: the client application, a client OLE DLL, a generic object management DLL, a server DLL, and the server application. All of these pieces must work in perfect harmony for OLE to function as the user expects. It's important to note that the OLE API functions are not part of *Windows* itself; the interface is defined by Microsoft, but the implementation is performed on a program-by-program basis by application vendors.

Let's walk through a highly simplified OLE scenario. When an OLE-aware client

PC MAGAZINE	SERVER ECD FUNCTIONS
EcdBlockServer	
EcdRegisterDocument	
EcdRegisterServer	
EcdRevokeDocument	
EcdRevokeObject	
EcdRevokeServer	
EcdUnblockServer	

Figure 9: The entry points to these functions are found in a server DLL. As part of the information passed to the DLL during registration, the server application provides addresses of entry points for routines that implement each of the operations (edit, create, destroy, show, and so on) that can be requested by a client on an object owned by the server.

application opens a document and finds that the document contains embedded or linked objects, it calls EcdRegisterClientDocument. During loading of the file, whenever the client reaches an embedded object, it calls the function EcdLoadFromStream, which in turn calls the server library for the object's class to bring the object into memory (the server understands the format of the object, whereas the client cannot). To display the object, the client sets up a device context and bounding rectangle and calls EcdDraw, which in turn calls the rendering functions in the class-specific server library. I'm glossing over a lot of the fine details here, but I think you'll get the idea.

When the user selects an object and indicates that he wants to edit it, the client application calls EcdOpen, which looks up the filename of the server application for the object's class in the system registry and then launches the application. The server is signaled that it is running as an OLE captive by the special command line switch `-Embedding`. The server then modifies its menu commands appropriately and registers itself by calling EcdRegisterServer, passing a structure that contains the addresses of the entry points for the various document and object "methods" (open, create, create from template, edit, save, release, and so on) that the server supports. Subsequent execution of the server is controlled by commands passed through from the client or by the user's direct interaction with the server. Typically, the server will be "silent" until the client sends it a pointer to an object and

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As you shop for a computer for use in your home, look for the FCC classification in the specifications or ask your vendor to recommend only machines that have been certified to the Class B limits. TV viewers and radio listeners in your home and in neighboring homes will be glad you did.

Power Programming

a command to open a window and prepare to edit the object. When the server exits, it must store away the updated object on behalf of the client and then call `EcdRevokeServer` to notify the OLE DLLs that its "method" entry points are no longer valid.

PROS AND CONS OF OLE

Clearly, OLE is a major step forward from the cold links, warm links, and hot links supported by today's DDE-capable *Windows* applications. OLE allows the user to deal with compound documents in a much more natural way, be-

DDEML, the fact remains that DDE as we know it today is a shaky foundation for a protocol as complex as OLE.

OLE also offers users a chance to really paint themselves into a corner. If a user has many different OLE-aware applications on his disk and uses them all to build complex documents that are chock-full of many different types of embedded objects, he may find that he's the only person in the known universe with a software/hardware configuration that is capable of presenting, editing, and printing the document. If he passes the document off to another user who doesn't have a system with the exact same suite of applications in the exact same versions, that user will just see a document with a hole that represents each object for which there is no server.

If you'd like more information about OLE, you should browse through the

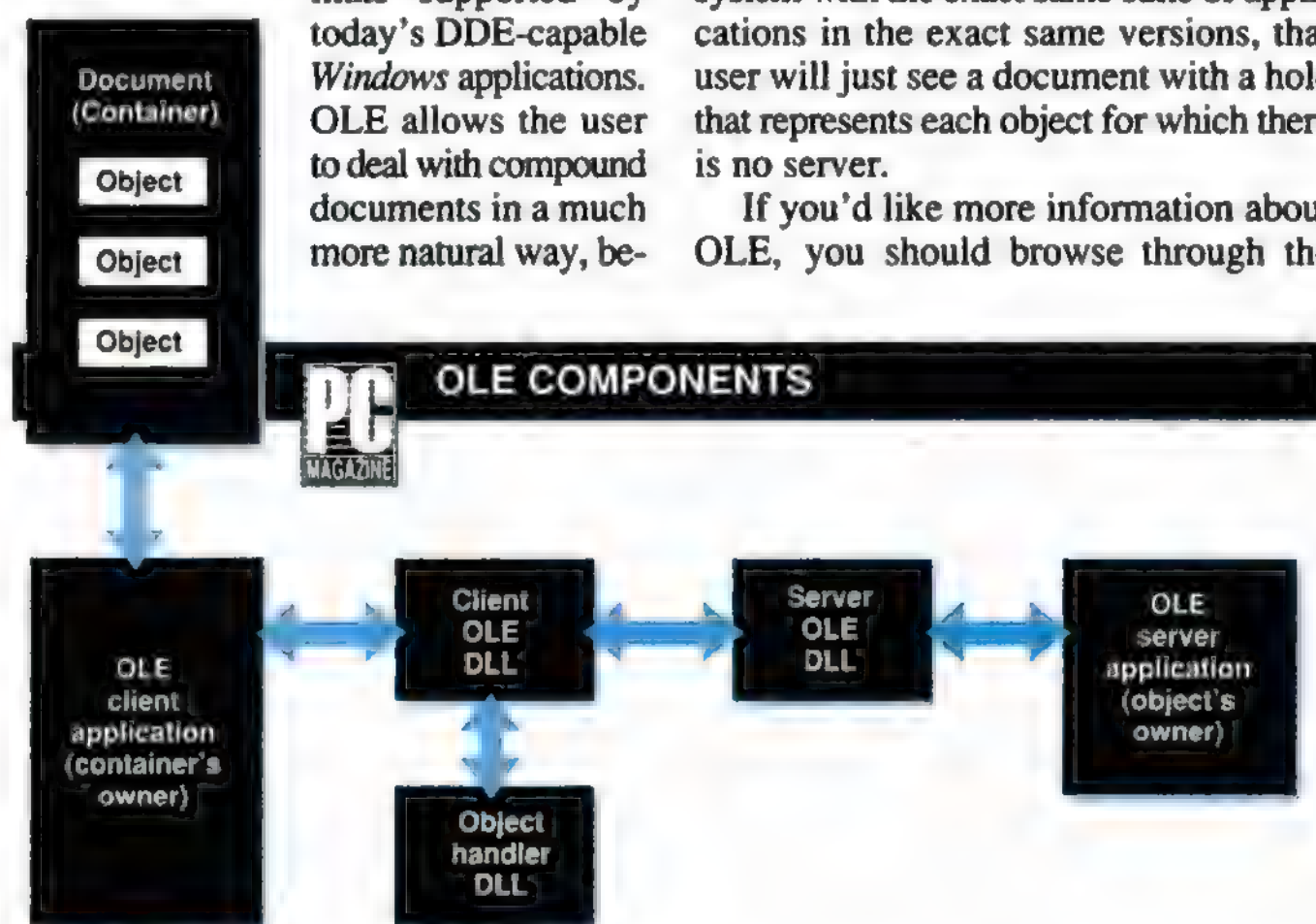


Figure 10: This illustrates the relationships among an OLE client, an OLE server, a complex document, and the DLLs that support the OLE services and API.

cause the burden of finding and loading the application responsible for each object is shifted to the OLE system as a whole. As a wide variety of server class libraries becomes available, the job of client applications will become easier; applications will no longer be obligated to understand and convert or render a host of alien data formats.

But there are also some storm clouds on the horizon. As currently specified, OLE relies to a significant extent on DDE to pass things around. Although the encapsulation of DDE into the DDEML API described in the last column shields applications (and the OLE client and server libraries) from the messy details of DDE transactions and allows for future improvements to the DDE mechanisms that will be transparent to applications that use

Object Linking and Embedding Extensible Application Protocol document, which is available from Microsoft Corp., One Microsoft Way, Redmond, WA 98052. I referred to the "January 1991 Beta Version" while writing this column, but an updated specification will undoubtedly be available by the time you read this. Prototype OLE-aware applications (Cardfile, Paintbrush, Shapes) and example source code can be downloaded from the Microsoft Forum on CompuServe.

THE IN-BOX

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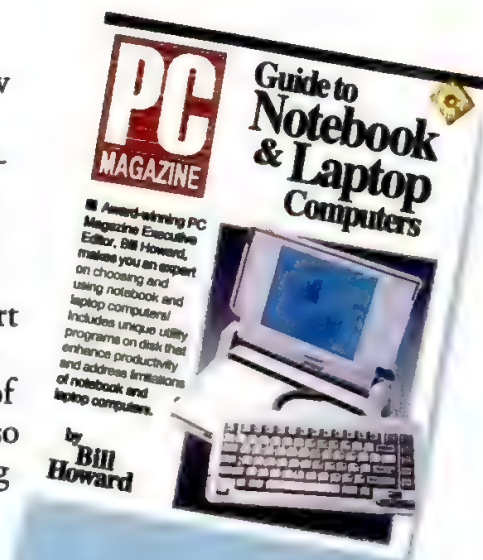


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by
Fran Finnegan

Windows

EXPAND THE SHELL'S ENVIRONMENT SPACE

When shelling out to DOS from *Windows* 3.0, you end up in the directory that *Windows* is in. But you can change that by editing the DOS icon Properties. In the Properties dialog box, just change the command line from `COMMAND.COM` to `C:\COMMAND.COM` (or any other directory).

Juan Elegado
Pensacola, Florida

 This technique has been written up before, but not with an interesting twist I've discovered about `COMMAND.COM`'s environment space.

When you fill in the Program Item Properties dialog box in Program Manager, the program on the command line doesn't have to reside at the end of the path you specify. If it does *not*, the Program Manager will report in a message box that "The specified path is invalid." (a sometimes-inaccurate message), which can safely be ignored by selecting the OK button. As long as the program is somewhere along the path in your DOS environment, *Windows* will find it when you run the program.

When you do run the program, Program Manager uses that command line in two ways. First, it extracts the program name that it will attempt to execute. Second, it extracts the path if you specified one and switches into that directory. After doing this, the Program Manager asks *Windows* to run the program. But before running it, *Windows* makes a copy of the DOS environment (that *Windows* inherited when it started up) for the program and then loads and runs the program. If the program is *not* in the directory you specified, it will then have to be found along the path in your DOS environment. For example, I keep my `COMMAND.COM` in `C:\DOS` and have the line

```
Shell=\DOS\COMMAND.COM C:\DOS  
/e:512 /p
```

■ EXPAND THE SHELL'S ENVIRONMENT SPACE:

You'll have more room in your environment if you specify a larger environment size on the DOS Prompt's command line in the Program Manager.

■ ADDING MORE COLOR TO WINDOWS 3.0:

For easier reading or just plain aesthetics, you can change the hue of a few interface items that aren't available in the Control Panel.

in my `CONFIG.SYS` and `C:\DOS` in my `PATH`. This is all nice and neat, but...

Like me, you might run some terminate-and-stay-resident (TSR) programs in this DOS shell. The problem is that *TSRs* prevent your DOS environment from being expanded (that is, added to) in a DOS shell under *Windows*! This happens because the size of the DOS environment that *Windows* sets up when it creates a DOS shell (or any DOS program that it runs) is the size of that portion of the DOS environment that was *actually used* when *Windows* started. It is *not* the size as specified in your `CONFIG.SYS` file (if you specified it with the `/e:size` argument). In other words, `COMMAND.COM` is treated like any other DOS program that *Windows* runs, and not the way that DOS treats it in `CONFIG.SYS`.

To solve this problem, manually append the `/e:size` argument to the DOS Prompt command line in Program Manager with the same size you have in your `CONFIG.SYS` file. This will tell `COMMAND.COM` to reallocate the full DOS environment size when it runs, leaving

you with extra space in the event you run any *TSRs*.

I would like to see this fixed for `COMMAND.COM` in a future version of *Windows* or see *Windows* automatically append the `/e:size` argument from `CONFIG.SYS` when it sets up the DOS Prompt icon in Program Manager. But in the meantime, this technique will work.

ADDING MORE COLOR TO WINDOWS 3.0

If you don't like the bland gray buttons of *Windows* 3.0, there's a simple way to get bright yellow, red, green or any other color of buttons. You can, in fact, set six more color elements than possible through the Control Panel (`CONTROL.EXE`). These elements are listed in Figure 1.

To choose a color for one of the elements, follow this short procedure. First, bring up the Control Panel. Then select Color, Color Palette and Define Custom Colors. Move the pointer to the color panel on the left side of the dialog box and choose some colors by clicking the mouse button. Under this palette, the actual color is defined by three numbers: red, green, and blue (RGB). Note the three numbers, in RGB order, for the colors you like. Hit the Esc key twice to Cancel the dialog boxes, and then close the Control Panel.

At this point, you'll edit the `WIN.INI` file using the `SYSEDIT`, Notepad, or a DOS

ADDITIONAL WINDOWS COLOR ELEMENTS

Elements	Descriptions
ButtonFace	The surface of a button
ButtonShadow	The shadow of a button
ButtonText	Text shown in a button
GrayText	All nonavailable items
Hilight	Background of selected items
HilightText	Text in selected items

Figure 1: These elements let you change the tint of several items that are not available in the Control Panel.

Windows



Basic color	RGB VALUE		
	Red	Green	Blue
Black	0	0	0
Blue	0	0	255
Red	255	0	0
Magenta	255	0	255
Green	0	255	0
Cyan	0	255	255
Yellow	255	255	0
White	255	255	255
Light gray	192	192	192
Dark gray	128	128	128

Figure 2: With three primary color components that can each range from 0 to 255, *Windows* can support almost 16.8 million colors provided you have a high-end graphics board.

text editor. Find the [Colors] section of WIN.INI. At the end of the list, enter any of the six new color elements along with the RGB values that comprise the color you want. For example, entering

`ButtonFace=255 255 96`

will give you gold buttons. You'll see the newly tinted buttons when you restart *Windows*.

Bodo Noering
Essen, Germany

PC MAGAZINE For those of you who've never dealt with *Windows* colors at this level, let me first describe how these RGB color values work. Then I'll elaborate on Mr. Noering's discovery.

RGB values in *Windows* are three-integer values that specify the relative intensities of red, green, and blue. Taken together, these values make up a particular color. Each primary color component can have one of 256 settings, from 0 (minimum intensity; no color) to 255 (maximum intensity; full color). To see why red, green, and blue are important, hold up a magnifying glass to your monitor; you'll see small dots of these colors, just as you would on a TV screen. For those who are wondering: there are 256 possible settings because there are 8 bits in a byte, and each bit can have two values (0 or 1); 2^8 is 256. With 3 bytes (for Red, Green, and Blue) representing a color internally, *Windows* can

handle 24-bit color graphics boards.

The table in Figure 2 lists the most-basic colors in *Windows*, as specified by their RGB values. To darken (in other words, lessen the intensity of) any of the eight basic colors, change the component 255s to 192s or 128s; this is how the grays are created from white.

If your own display driver can't represent the requested color, *Windows* or the display driver (depending on the context of the request) will do one of two things: Choose the nearest solid color it *can* represent, or dither (alternate) adjacent pixels with solid colors in an effort to approximate the color. Monochrome display drivers will either choose the nearest gray, or dither grays.

Given this framework and the examples in Figure 2, the entries in the [Colors] section of WIN.INI should make sense to the reader. Now, on to the gem Mr. Noering discovered.

The color keywords he uncovered aren't listed in WIN.INI by default, because they can't be used to change *all* aspects of the visual interface. In particular, the button entries (ButtonFace, ButtonShadow and ButtonText) can only be changed to some extent. Changing their

what the bitmaps look like. For example, *Excel* and *Word for Windows* use the button colors when they create application-specific buttons.

If you want to change the RGB values for these "new" color entries, it is helpful to first know what the default RGB values are. The table in Figure 3 lists these default values for some common display drivers.

It should be noted that you can also use Paintbrush (PBRUSH.EXE) to experiment with RGB values. Simply double-click on a color in the palette at the bottom of the Paintbrush window. A dialog box will appear showing the RGB values. Then click on a different color in the palette to see its RGB values.

I have Hilight=255 0 0 (red) and GrayText=128 128 128 (dark gray) on my VGA and 1024-by-768 monitors. This Hilight setting makes selected text more noticeable in Edit controls of dialog boxes. The GrayText setting makes disabled menu items more readable in my yellow menus. One more thing: If you run my small utility, COLORS.COM (available on PC MagNet), you can have your new tones take effect without exiting *Windows*.



WIN.INI [Colors] keyword	EGA color default RGB values	VGA color default RGB values	1,024 by 768 color default RGB values
ButtonFace	=255 255 255	=192 192 192	=192 192 192
ButtonShadow	=128 128 128	=128 128 128	=128 128 128
ButtonText	= 0 0 0	= 0 0 0	= 0 0 0
GrayText	=128 128 128	=192 192 192	=192 192 192
Hilight	= 0 0 0	= 0 0 0	= 0 0 0
HilightText	=255 255 255	=255 255 255	=255 255 255

Figure 3: If you do not override them by explicitly changing your WIN.INI file, these are the default RGB values that most display drivers use for these "new" color entries under three common display resolutions.

RGB values in WIN.INI does *not* alter the appearance of the small buttons (such as system menu, minimize, maximize, restore, or scroll bar bitmaps) that make up the user interface of *Windows*.

These six color entries are made available to *Windows* application programmers as information about the "look" they should strive for. Consequently, the entries are used primarily by the standard dialog controls (such as buttons) so that they can appear color-coordinated with the user interface bitmaps. They are intended to allow applications to know

OPENING WINDOWS

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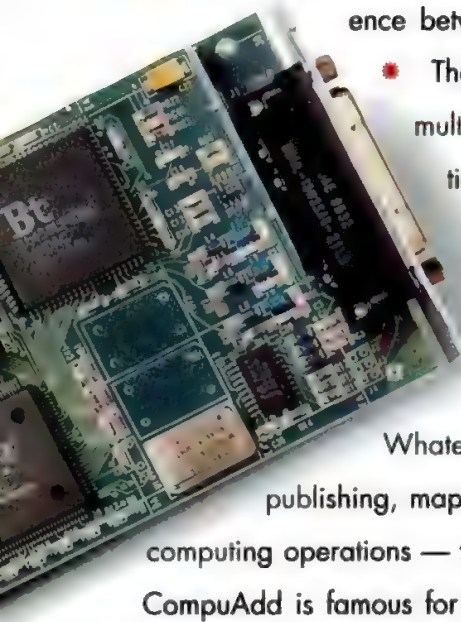
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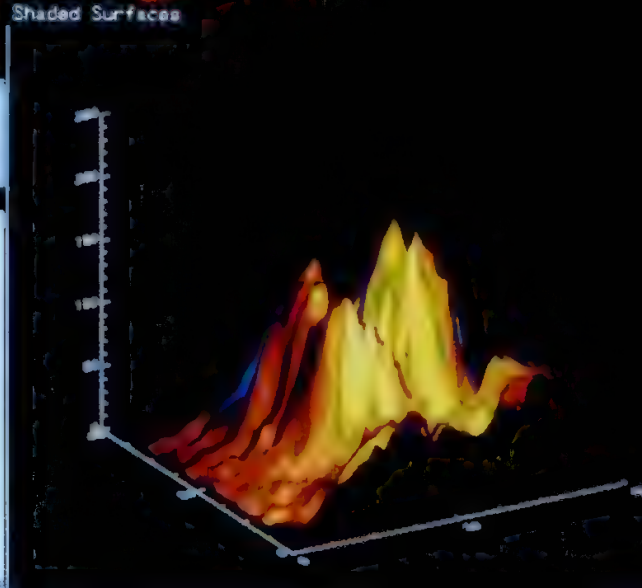
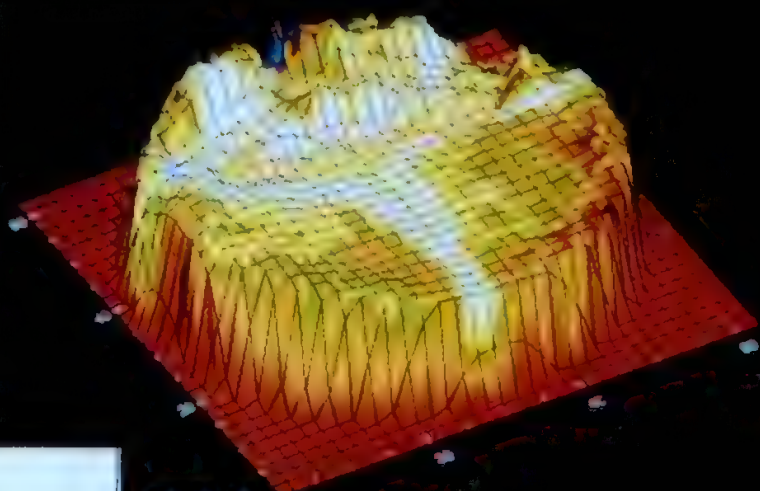
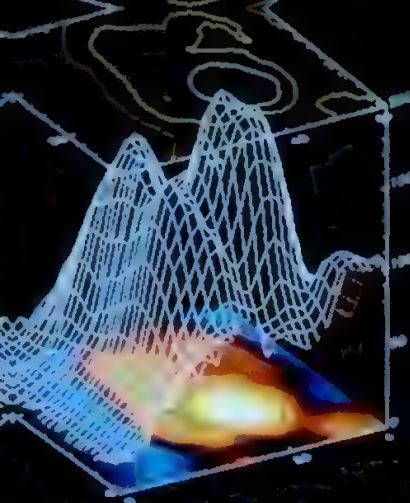
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by
Sal Ricciardi

Databases

PARSING COMMA-DELIMITED LISTS INTO ARRAYS

One of the enhanced features of *Clipper* 5.0 is its array handling. You can now initialize an array with an assignment statement such as:

```
aNumber := ;
{100,200,"Three Hundred",400}
```

Not only is this statement a quick way to initialize arrays, it also can be used to parse a comma-separated list of values. Let's suppose that you have read a comma-separated list of values from a data file into the variable `LineRead`, where

```
LineRead = ;
'100,200,"Three Hundred",400'
```

You might then want a function that takes this string as input and returns an array with four values. Writing such a function would normally involve using the `AT()` function within a loop to locate each comma, while placing each substring into an array element. Not only would this take several lines of code, but you would probably need another loop to determine the size of the array to declare, or an empty array declaration followed by use of the `AADD()` function to add each element.

A much quicker way, using *Clipper* 5.0, is to treat the list as a literal array using the

■ **PARSING COMMA-DELIMITED LISTS INTO ARRAYS:** *Clipper* 5.0's enhanced array handling can streamline certain tasks.

■ **A PREPROCESSOR FOR dBASE:** How to use the Microsoft C Compiler's preprocessing feature with your *dBASE* programs.

macro operator. The following function will take a comma-separated list of values and return an array:

```
Function GetParmList(plist)
return &({'+plist+'})
```

The example shown in Figure 1 demonstrates the use of this function.

Scott K. Sheck
Greenbelt, Maryland



The in-line assignment operator and enhanced array features introduced in *Clipper* 5.0 can indeed come in handy. Starting with release 5.0, *Clipper* allows array creation and initial-

ization through an in-line assignment, as in

```
narray := {10,20,30}
```

This both declares and creates the array with the values between the brackets. If the array is expressed as a character string, as in "{10,20,30}", it can be expanded using the macro operator as follows:

```
cstring = "{10,20,30}"
narray = &cstring
```

The line above creates the array named "narray" with the first three elements initialized to 10, 20, and 30, respectively.

This leads to some interesting possibilities, such as the parsing of comma-delimited input suggested above by Mr. Sheck. The objective of the `GetParmList` function is to take a comma-delimited string and package it like the right side of the `cstring` assignment shown above (the "{10,20,30}"). The result can then be expanded using the macro operator and assigned to an array. This may be useful for creating custom import routines that operate on comma-delimited files output by other applications. For example, you could read a line from a comma-delimited file, assign the data to an array, manipulate the data in some fashion appropriate to your application, and only then append the record to the database.

PARSE.PRG

COMPLETE LISTING

```
* PARSE.PRG
*--- Example comma-separated list
LineRead = '100,200,"Three Hundred",400'

*--- Parse list, placing each element in an array
myArray = GetParmList(LineRead)

*--- Print array values
for x=1 to len(myArray)
? myArray[x]
next x
return

*---
Function GetParmList(plist)
return &({'+plist+'})
```



Figure 1: The program shown here illustrates how you can parse a comma-delimited string into an array using *Clipper* 5.0's macro operator.

A PREPROCESSOR FOR dBASE

While working with *dBASE* languages for the past few years, I've always wished for an inexpensive preprocessor that supports symbolic substitution and the `include` command to insert text from another file.

Clipper 5.0 now supports these features, but many of my clients are using other *dBASE* products. While I wait for all of the *dBASE*-compatible languages to include preprocessor support, I've discovered that I can use my Microsoft C compiler as a macro preprocessor to *FoxBASE Plus* and *FoxPro*.

In order to do this with *FoxBASE Plus*, I compile my *FoxBASE Plus* programs using

TEST.PRG

COMPLETE LISTING

```
*
* TEST.PRG - Test program to demonstrate use of C preprocessor *
*

#include "test.h"      /* Include files
#include "startup.h"
USE FILE              /* Note that FILE will be replaced
mchr = SPACER(fieldchr) /* Note that SPACER will be replaced
mnum = INITIALNUM      /* Note that INITIALNUM will be replaced
mdat = TODAY           /* Note that TODAY will be replaced
05,10 GET mchr PICTURECHR /* Note that PICTURECHAR will be replaced
06,10 GET mnum PICTURENUM /* Note that PICTURENUM will be replaced
07,10 GET mdat
READ
APPEND BLANK
REPLACE fieldchr WITH mchr;
      fieldnum WITH mnum;
      fielddat WITH mdat
QUIT

* STARTUP.H
CLEAR ALL
SET TALK OFF
SET BELL OFF
SET STATUS OFF

* TEST.H
#define FILE          test
#define INITIALNUM    0
#define PICTURECHR    PICTURE "!!!!!!!"
#define PICTURENUM    PICTURE "999999"
#define SPACER(n)     SPACE(LEN(n))
#define TODAY         DATE()
```



FoxBASE Plus pseudocompiler on the pre-processed output.

TEST.PRG is a sample program that uses symbolic substitution to declare and initialize values for variables and to use PICTURE clauses. Figure 2 shows TEST.PRG before preprocessing and its two Include files. Figure 3 shows TEST.I after preprocessing.

Jon Postyn
Forest Hills, New York



As Mr. Postyn suggests, if you own a C compiler that supports creating a preprocessed version of the source file, there's no reason why you can't use it for dBASE source code (or any other language, for that matter). Luckily,

A preprocessor adds
flexibility to program
development by
providing the ability to
define symbolic
constants.

Figure 2: The TEST.PRG sample program before the source file has been preprocessed, along with the TEST.H and STARTUP.H Include files.

THE TEST.I FILE OUTPUT AFTER PREPROCESSING

```
*
* TEST.PRG - Test program to demonstrate use of C preprocessor *
*

* TEST.H

* STARTUP.H
CLEAR ALL          /* Inserted from STARTUP.H
SET TALK OFF
SET BELL OFF
SET STATUS OFF

USE test
mchr = SPACE(LEN(fieldchr)) /* FILE was replaced
mnum = 0              /* SPACER was replaced
mdat = DATE()        /* INITIALNUM was replaced
05,10 GET mchr PICTURE "!!!!!!!" /* TODAY was replaced
06,10 GET mnum PICTURE "999999" /* PICTURECHR was replaced
07,10 GET mdat
READ
APPEND BLANK
REPLACE fieldchr WITH mchr;
      fieldnum WITH mnum;
      fielddat WITH mdat
QUIT
```

Figure 3: This shows TEST.I output after preprocessing. Notice that the Include files have been merged and the symbolic constants have been replaced.

the following batch file:

```
c1 /EP /P /Tc11.PRG
foxpcomp 11.1
```

The c1 line invokes the Microsoft C 6.0

compiler. The /EP option tells the compiler to preprocess the source file without #line directives, and the /P option tells the compiler to save the preprocessed output file to disk with an .I file extension. The foxpcomp command then invokes the

Microsoft C can be set up both to preprocess-only and to output the results to a file, which makes it a good choice for this assignment.

A preprocessor reads your program source file as input and produces a preprocessed ASCII file as output. It adds a great deal of flexibility to program development by providing you with, among other things, the ability to define symbolic constants. A symbolic constant is something that the preprocessor replaces with a literal value.

For example, if you'd like to use BLACK instead of N and BLUE instead of B when representing dBASE colors, define the symbolic constants like this:

```
#define BLACK N
#define BLUE B
```

and place them in an Include file. Then use #include to tell the preprocessor to merge the Include file with the source file (the #define and #include are called preprocessor directives).

Databases

Thereafter, you can use SET COLOR TO BLUE/BLACK where you would normally use B/N. Another common use is to assign symbolic names to keystrokes. For example, instead of writing

```
IF READKEY() == 12    44 Escape
```

you might define a symbolic constant for the escape key via

```
#define Esc 12
```

and then write

```
IF READKEY() == Esc
```

One advantage symbolic constants have over using memory variables (like BLACK='N') is that they require no run-time memory. Symbolic constants are entirely resolved by the preprocessor before the compiler or interpreter are even run. In addition, since there is no overhead required for maintaining a memory variable,

symbolic constants are more efficient.

You can also define macros using the preprocessor. For instance, we can use the IIF (immediate if function) to construct a

**Symbolic constants
are entirely resolved by
the preprocessor
before the compiler or
interpreter are run.**

MAX macro as follows:

```
#define MAX(a,b) IIF(a > b, a, b)
```

and then do something like

```
? MAX(10,9)
```

A preprocessor is useful for other reasons, too. For example, you can use it for condi-

tional compilation, letting you include or exclude sections of code depending on some condition.

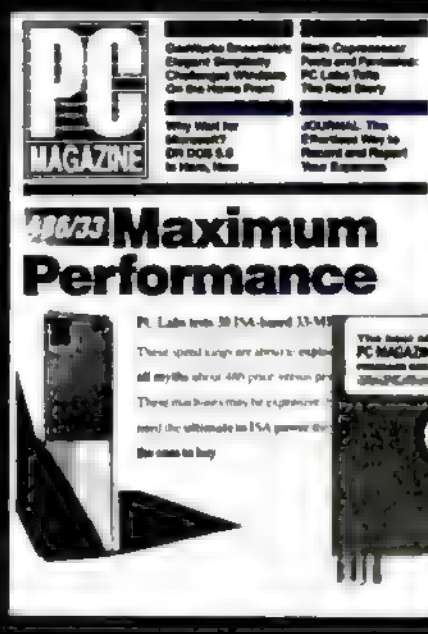
```
#ifdef MULTIUSER
... Multiuser code
#else
... Single user code
#endif
```

The major disadvantage to using a preprocessor is the additional processing time it requires.

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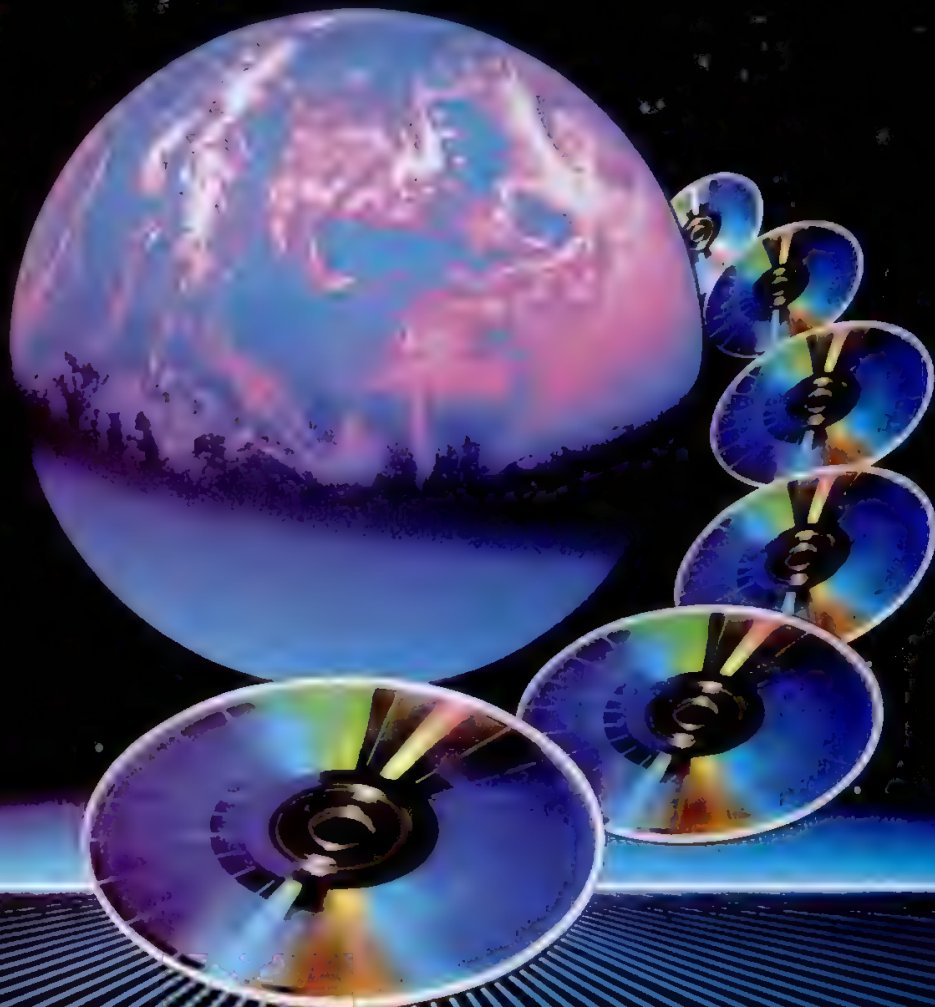
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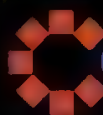


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Spreadsheets

LITTLE-KNOWN DEBUGGING TIPS

Have you ever wished you could kick your 1-2-3 macros into STEP mode while they were running? Or that you could set conditional breakpoints in your macros? I have found a way to do both.

By experimenting, I discovered that 1-2-3, Release 2.2, allows you to press Alt-F2 to turn on STEP mode whenever a macro requests keyboard input. Thus, inserting dummy `getnumber`, `getlabel`, or `{?}` commands into your macros frees you from having to single-step through an entire macro just to trace through a section that's giving you problems.

For example, if I want to turn on STEP mode before a particular instruction, I just precede that instruction with

```
{beep}{beep}{?}
```

The two beeps remind me that I need to press Alt-F2 to activate STEP.

You can also use this technique to set up conditional breakpoints—places where the macro goes into STEP mode only if some condition is met. To do this, write a statement such as

```
{if condition}{beep}{getlabel  
"Error! Press Alt-F2",DUMMY}
```

If you want to watch the value of certain variables while the macro runs, you can use /Worksheet Window to freeze the area that contains those variables.

These techniques can help you turn macro development into more of a science than an art. And you won't have to spend big bucks on an add-in debugger.

Shay Patel
Plano, Texas



It's unfortunate that the 1-2-3 macro language doesn't include a keystroke named `{STEP}`. This would let you turn single-step processing on and off with self-explanatory code, instead of having to resort to dummy input statements.

■ **LITTLE-KNOWN
DEBUGGING TIPS:**
Set conditional
breakpoints or enter
STEP mode while your
macros are running.

■ **FASTER NAVIGATION IN
EXCEL:** Several
procedures let you
jump more quickly
between distant areas
on a worksheet.

■ **SINGLE-CELL ANCHORS
IN .WK1 FILES:** When
you convert .WK3 files
to .WK1, single-cell
ranges may remain
anchored and you will
have problems with
@@ functions.

Quattro Pro's `{STEPON}` and `{STEPOFF}` commands seem like obvious candidates for addition to the Lotus programmer's toolkit.

Nevertheless, the procedures described by Mr. Patel (as well as by the Lotus manuals—see page-14-12 of the Release 2.2 reference manual) work just fine. Note that you can also turn STEP mode off while a macro has paused for input. Thus, you might want to surround a trouble spot with a pair of `{?}` statements—one for turning STEP on, the other for resuming full-speed execution.

I don't often plug products in this column, but I can't resist a tip-o'-the-hat to Personics Corp. in Maynard, Massachusetts, for its superb add-in debugger MED (Macro Editor/Debugger). MED makes it easy to set up watchpoints and breakpoints of various kinds. It also provides clear explanations of error conditions, lets you examine any part of the 1-2-3 work-

sheet while your macro is running, and includes a valuable set of macro-editing commands. It's the best thing that's happened to 1-2-3 macro programming since Lotus decided to let the "keystroke alternative" remain in Release 1.0.

FASTER NAVIGATION IN EXCEL

Often I work on large *Microsoft Excel* worksheets and must copy data between two widely separated locations. To avoid lengthy scrolling procedures, I've written the pair of macros shown in Figure 1. The first macro, activated with Ctrl-Z, remembers the current selection. The second, activated with Ctrl-X, returns me to the selection remembered by Ctrl-Z. This macro pair makes it easier to navigate on a large worksheet or between worksheets.

Paolo Tosolini
Muggia, Italy



Actually, if you need to store only one cell or range for later reselection, you can use *Excel's* Formula Goto command (F5). Whenever you use Goto, *Excel* remembers the current selection; the next time you use it, the most recent range you went from becomes the default Goto target.

For example, suppose the current selection is B60:D80, and you use the Goto command to travel down to cell Z1000. The next time you use the Goto command, no matter where you've been in

NAVIGATE.XLM

```
A  
1 Remember Selection (Ctrl-z)  
2 =REFTEXT(SELECTION())  
3 =GET.WINDOW(1)  
4 =RETURN()  
5  
6 Return to Selection (Ctrl-x)  
7 =ACTIVATE(A3)  
8 =SELECT(TEXTREF(A2))  
9 =RETURN()
```

Figure 1: This pair of *Excel* macros makes it easier to move around a large worksheet or between worksheets.

Spreadsheets

the meantime, the Goto dialog box will present B60:D80 as a default.

This feature works between worksheets as well. Say you use Goto while the current selection is E15 on INCOME.XLS, and you later switch to a worksheet named EXPENSES.XLS. The next time you use the Goto command, the reference line will display the default selection: INCOME.XLS!E15. (If you have closed INCOME.XLS in the meantime, the reference line will be blank.)

Thus, if you want to store a selection as what Microsoft likes to call a "bookmark," simply highlight it and execute a Goto. Then you'll be able to return to it just by pressing F5 and Enter.

This technique has limitations. It lets you store only one bookmark range, and it restricts your use of Goto for other purposes. To store a bookmark range without tying down the Goto command, you can use Mr. Tosolini's pair of macros. And if you have several ranges that you want to be able to return to quickly, you can easily expand Mr. Tosolini's idea. Just duplicate his pair of macros and assign each macro a different keyboard shortcut. Figure 2 shows how you might set up macros to make three bookmark ranges available.

Note the keyboard shortcuts used in Figure 2. Excel distinguishes between lowercase and capital letters in macro keyboard shortcuts. So Ctrl-a stores bookmark A, and Ctrl-A reselects that bookmark. Ctrl-b and Ctrl-B do the same for bookmark B, and so on.

SINGLE-CELL ANCHORS IN .WK1 FILES

I was interested in the column on named ranges in Lotus 1-2-3 that appeared in your November 27, 1990, issue. As you pointed out, "unanchored" single-cell range

REL3FIX.WK1		
A	B	C
1	\F	{windowsoff}{paneloff}
2		{goto}\F{1}
3		{r 3}/rnt
4		{end}{d 2}
5		@count({u}.{end}{u})
6		/rvFIXC
7		/re{end}{u}{r}
8		{let FIXB,0}
9		{end}{home}{goto}\F
10	FIXA	/inc{r FIXB}
11		{let FIXB,FIXB+1}
12		{windowson}{windowsoff}
13		{if FIXB=FIXC}{home}{quit}
14		{branch FIXA}
15		
16	FIXB	4 Processed
17		
18	FIXC	4 Total Range Names

Figure 3: After using Translate to convert .WK3 files to .WK1 format, run this macro to change single-cell ranges to an unanchored format.

names in Release 2.x are always translated into "anchored" range names in Release 3.x. That is, a name assigned to A1 in a .WK1 file is invariably assigned to A1..A1 on translation to the .WK3 format.

I've discovered that if you use the Lotus Translate utility to convert a .WK3 file back to .WK1, anchored single-cell range names remain anchored after the translation. Continuing the illustration above, a name assigned to A1..A1 in Release 3.x is still assigned to A1..A1 in Release 2.x.

Unfortunately, this can create problems. Some of the Release 2.x functions do not perform properly when applied to an anchored single-cell range name.

Suppose the name TEST is assigned to A1..A1, that A1 contains the label B1, and that cell B1 contains the value 100. Under these conditions, the formula

@@(TEST)

should return 100. It doesn't; it returns 0. The formula works correctly if the name

TEST is assigned to A1, but it fails if TEST is assigned to A1..A1.

To deal with this problem, I wrote the macro in Figure 3. To use this macro, combine it with a .WK1 file translated from 1-2-3, Release 3.x. Move to a clear area of the translated worksheet, use /FCCE to import the macro, and then use /RNLR to assign the range names \F, FIXA, FIXB, and FIXC. Press Alt-F to convert all anchored single-cell range names to their unanchored equivalents.

This macro assumes that the worksheet in which it's used does not already use the names FIXA, FIXB, FIXC, and \F.

Robert R. Graham

Chesterfield, Missouri



It's true that the Release 2.01 and Release 2.2 @@ function does not work correctly when its argument is a name assigned to an anchored single-cell range (that is, a range specified in the form A1..A1). However, to the best of my knowledge, anchored single-cell ranges work fine in all other circumstances.

If TEST is assigned to A1..A1, for example, and A1 contains the value 100, then +TEST returns 100, just as it would if TEST were assigned simply to A1. Similarly, @CELL("address",TEST) returns \$A\$1, not \$A\$1..\$A\$1. In short, the problem with @@ appears to be an isolated bug, not a symptom of widespread problems with .WK1 files translated from the Release 3.0 environment.

But that won't comfort you much if you use @@ and work with both releases. If you find yourself in those circumstances, you can take advantage of Mr. Graham's macro to get rid of the anchor on your single-cell ranges.

An alternative approach to solving this problem is to avoid using the Release 3 Translate program. As long as your Release 3 files occupy only one worksheet page, you can translate them to Release 2's format simply by saving them with the .WK1 extension. When you do it this way, your single-cell ranges drop their anchors automatically.

HINTS, TIPS, QUESTIONS

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NAVIGATE2.XLM			COMPLETE LISTING		
A	B	C	A	B	C
1	Store_A (Ctrl-a)	Store_B (Ctrl-b)	Store_C (Ctrl-c)		
2	=REFTEXT(SELECTION())	=REFTEXT(SELECTION())	=REFTEXT(SELECTION())		
3	=GET.WINDOW(1)	=GET.WINDOW(1)	=GET.WINDOW(1)		
4	=RETURN()	=RETURN()	=RETURN()		
5					
6	Reselect_A (Ctrl-A)	Reselect_B (Ctrl-B)	Reselect_C (Ctrl-C)		
7	=ACTIVATE(A3)	=ACTIVATE(B3)	=ACTIVATE(C3)		
8	=SELECT(TEXTREF(A2))	=SELECT(TEXTREF(B2))	=SELECT(TEXTREF(C2))		
9	=RETURN()	=RETURN()	=RETURN()		

Figure 2: These sets of macro pairs, and expansions of the macros in Figure 1, let you store and move to three selected ranges.

by
Costa Rodis

The Working Word

A HEADER FOR EVERY COLUMN

The Labels feature of *WordPerfect* 5.1 is useful for much more than printing labels. *WordPerfect* doesn't let you put a header at the top of each column when you use the Columns command (Alt-F7), so I define columns by using the Labels feature. This way the same header appears at the top of each column; footers work equally well. Assuming you want two columns on 8.5-by-11-inch paper, follow these steps for defining and using Labels as columns:

- Press Format (Shift-F8), Page (P), Paper Size (S).
- Move the highlight bar to Standard Paper type and Orientation (8" x 11").
- Press Edit (E) and then Labels (a), Yes. A screen headed "Format: Labels" will then appear.
- Select Label Size (S) and set the width to 3.5 inches and the height to 10 inches.
- Set the Number of Labels (N) to 2 columns and 1 row.
- Select Top Left Corner (C) and set the Top and Left measurements to 0.5 inches each. These settings give you margins of .5 inch.
- Set the Distance Between Labels (D) to 0.5 inches for Column and to 0 for Row.
- Leave Label Margins (M) at 0 inches for Left, Right, Top, and Bottom.
- Tap Exit (F7) twice, Select (1), and Exit (F7) once more.
- If you Reveal Codes (F11 or Alt-F3) you should see the code [Paper Sz/Typ:8.5" x 11", Standard, 3.5" x 10"].
- Now you simply create a header (Shift-F8, PHAP). If you prefer footers, substitute PFAP for PHAP.

When you're back in the editing screen, enter the text for the first column. The text wraps at a column width of 3.5 inches and remains in the current column until a soft page break is created or you insert a hard page break (Ctrl-Enter). The second column will start after the page break. Note that each column appears as a separate page unless you look at your document with Print (Shift-F7), View (6).

This is a great trick for making long

■ **A HEADER FOR EVERY COLUMN:** *WordPerfect's* Columns command won't let you put a header at the top of each column, but its Labels feature will.

■ **UNDOCUMENTED CURSOR MOVEMENT:** Through its five keyboards, *WordPerfect* offers some very handy if unknown keystroke combinations, including one to move the cursor from sentence to sentence.

lists that require the same header or footer for each column. If the number of rows is increased, the header and footer appear in each row as well as in each column. The possibilities are endless!

Jerry Anderson
Glendale, Arizona



I don't know that the possibilities are exactly endless, but I love the simplicity and logic of this idea. Most people are not aware of *WordPerfect* 5.1's ease in formatting labels. Using this capability to create columns, while not intuitive, certainly addresses the rare problems of using the Columns feature. Not only headers and footers, but footnotes too are printed in relation to the "label" rather than to the page.

I would suggest that you do *not* follow Mr. Anderson's instructions to the letter. If you change your Standard Page Size format, most of your existing and all new documents will conform to the new changes. Instead, you should create a new Page Size, such as "Label-type Columns, Standard Portrait." To make a new Page Size, substitute the second step with the

following directions: Press Add (A). A list of typical page sizes will appear. Choose Other (O) and enter the name of the new Page Size definition you are creating. Then, you can pick up the original procedure by selecting the Label option. This modification lets you use label-type columns when you like rather than all the time.

When you do create a header or footer, the text appears by label or column, not by page. If you've chosen page numbering or included page numbering in the header or footer, page numbering is consecutive from column to column instead of from page to page. Just be sure to create your header, footer, and page numbers from the top of the first label. Otherwise, they will not appear or work properly until the next label is created.

UNDOCUMENTED CURSOR MOVEMENT

In *WordPerfect* 5.1, Ctrl-Right Arrow and Ctrl-Left Arrow allow you to move through a document one word at a time. Ctrl-Up Arrow and Ctrl-Down Arrow move the cursor one paragraph at a time. But there doesn't seem to be any documented way to move the cursor from one sentence to another. I've stumbled across a way to do just that by using the Alt key and the Up or Down Arrow. Alt-Down Arrow jumps the cursor to the next sentence, while Alt-Up Arrow moves the cursor to the beginning of the previous sentence.

Another undocumented keystroke I've also found is that Alt-Left Arrow or Alt-Right Arrow move the cursor to the left margin. This works even if the margin extends beyond the left edge of the screen. Not only that, but it's a lot faster than using Home-Home-Left Arrow!

Raymond W. McCauley III
College Station, Texas



What Mr. McCauley has stumbled across is not so much undocumented *WordPerfect* 5.1 functions as fairly clever macros married to specific

The Working Word

key combinations. Other shortcuts include tapping Ctrl-Home twice in a row to return the cursor to its immediately previous position; repeating the keystrokes makes the cursor jump back to its original position. Ctrl-F12 cuts a block of text and Alt-F12 copies a block of text. Shift-F11 toggles italics on or off, while Ctrl-F11 toggles Large Text.

Most of these special keystrokes are configured in the Enhanced keyboard layout, which can be edited from the Setup menu. But some shortcuts, including Ctrl-Up, Ctrl-Down, and tapping Ctrl-Home twice are built-in *WordPerfect* keystrokes and not part of the Enhanced keyboard layout.

To take a look at your key macros, go into Setup (Shift-F1) and tap K for Keyboard Layout. You should see a list of keyboard layouts. If you do not, hit your Enter key and then tap L for Location of Files. At Keyboard/Macro Files, type in the full path of where these files should be—typically in C:\WP51. After entering this information, return to the Keyboard Layout list. Move the cursor to Enhanced Keyboard and tap E for Edit. A list of key macros will appear, with a brief description of what each macro does.

To take a peek at how these macros work, move the cursor to a key name and then select Action (A). A macro action screen opens, containing the macro code associated with that key or keystroke combination.

The basic idea behind the Alt-Down Arrow key combination is relatively simple. By using the standard Move function you can block an entire sentence. If

you cancel Move with F1, the cursor will be positioned at the end of the current sentence. To move the cursor forward to the beginning of the next sentence, tap Ctrl-Left Arrow (Word Left) and then Ctrl-Right Arrow (Word Right). Such a macro might look like this:

```
(DISPLAY OFF)
(Move)s(Cancel)
{Word Left}{Word Right}
```

But the folks at *WordPerfect* recognized that this sequence of commands

*WordPerfect 5.1 has
some fairly clever
macros that can
help you move
through a document
more easily.*

does not meet all possible conditions. What if no text follows the current sentence? What if Block is on? What if you're in a Table? What if the cursor is in a menu or a macro action table?

The actual Alt-Down Arrow key macros, as shown in Figure 1, are more complicated. It begins with the statement

```
{IF}{STATE}&4~
```

which makes sure that you are currently working in the normal editing screen. In

other words, the macro is made aware that it should operate only when the screen displays your current document.

The next statement is

```
{IF}{SYSTEM}document~&512~
{Item Down}
```

This line determines whether the status of the current document on the screen has the cursor in a table. If it does, the cursor is moved down one cell.

If the cursor isn't in a table, the macro tests whether or not Block is on. If it is on, the macro advances the Block to the end of the sentence and from there to the beginning of any following text. The code for that action is as follows:

```
{IF}{STATE}&128~
.{Word Right}
```

Should Block not be active, the macro goes ahead with using Move and then canceling it to advance the cursor to the end of the sentence:

```
{ELSE}
{DISPLAY OFF}
{Word Right}{Left}
{Move}s(Cancel)
{Word Left}{Word Right}
```

Finally, each {IF} statement must be answered with an {END IF}.

There's no mysterious, undocumented programming magic happening with this macro. In some cases, little-known shortcuts can be discovered, while in others you may feel chagrined to find the same old keystrokes hidden behind a new key combination (Ctrl-Home, -Left or -Right Arrow, which moves the cursor to another column, is assigned to Alt-Left Arrow or Alt-Right Arrow). Take a look at these key macros and you'll discover new—and old—ways to skin the *WordPerfect* cat.

TIPS FROM WORKING WORDSMITHS

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ALT-DOWN ARROW MACRO

```
{IF}{STATE}&4~                {;}Only at main editing screen~
{IF}{SYSTEM}document~&512~
{Item Down}
{ELSE}
{IF}{STATE}&128~                {;}Block state~
.{Word Right}
{ELSE}
{DISPLAY OFF}
{Word Right}{Left}
{Move}s(Cancel)
{Word Left}{Word Right}
{END IF}
{END IF}
{END IF}
```

Figure 1: This built-in *WordPerfect* 5.1 macro, activated by pressing Alt-Down, moves your cursor to the beginning of the next sentence. It also offers a good lesson in macro programming.

by
Neil J. Rubenking

User-to-User

HIDING SCREEN MESSAGES

Your January 16, 1990, column recommended putting PROMPT commands before ECHO OFF when using ANSI key redefinitions in a batch file. Unfortunately, if you do this, all the ANSI sequences appear on the screen every time you run the batch file, and this is confusing for many users.

For PCs running under DOS 3.3 or later, here's a nice trick to suppress these useless messages. All you have to do is put the @ character before every PROMPT command and a blank line after it (see Figure 1 for an example).

I must admit I discovered this trick by chance—I don't understand why you need the blank line. But it works, and my batch files don't produce garbage on the screen any more.

Kao Wei-Chao
Brussels, Belgium

 DOS 3.3 added features to the batch language, most notably the invaluable CALL statement and the ability to prevent a single batch line from being echoed by beginning it with the @ symbol. Certainly the most common use of the @ sign is in front of the ECHO OFF statement that begins most batch files, but it can be used just as well before any other command.

Why do the ANSI redefinitions work only if followed by a blank line? Well, we know that for an ANSI command to take effect, it absolutely *must* be written to the

■ **HIDING SCREEN MESSAGES:** Here's a neat trick for suppressing useless on-screen messages.

■ **TRIMMING YOUR TREE:** This short batch file will help you prune your directory tree.

■ **REPEATING BATCH COMMANDS:** Use EDLIN to repeat batch commands any number of times.

screen. That's why they have to come before the ECHO OFF statement in a batch file. A PROMPT command preceded by an @ sign is not itself echoed to the screen, nor does it cause the prompt to be displayed. But a blank line *does* display the prompt—it's just like hitting Enter at the DOS prompt. Without the blank line, the key redefinition never gets written to the screen and hence has no effect.

TRIMMING YOUR TREE

We wrote a batch file (see Figure 2) to help empty and remove directories from a network drive where they were temporarily stored. We used the fact that

This worked well except that we still had to respond to the "Are you sure (Y/N)?" prompt every time we used it.

We based our solution on an idea from an old User-to-User column. The line

ECHO Y | DEL %1

sends a Y and a carriage return to the DEL command—it works perfectly. Of course, it's a dangerous operation—you can very quickly delete lots of files, but it's very useful. The process of piping responses to DOS commands with ECHO appears to have a lot of potential!

Christopher Norloff and Brian Hall
Great Mills, Maryland



If you trim a branch from the flowering plum tree in your garden, you can't just glue it back on later. With this in mind, you consider carefully before pruning. The same holds true for your directory tree—once you've used PRUNE.BAT, you'll have a tough time recovering any files that you have deleted. If you're squeamish, it might be a good idea to leave the "Are you sure?" prompt in place.

Note that PRUNE will fail if the directory has any subdirectories or any nondeletable files (Hidden, System, or Read-Only). It will also fail if a SUBST drive is assigned to the directory. I added a final line to check whether the pruning operation was successful—if the directory still exists, it wasn't.

PRUNE also exists as a utility. It was written by Michael Mefford and presented in the June 26, 1990, Utilities column. The utility program will chop off a directory and all the files and subdirectories below

ANSIPROM.BAT COMPLETE LISTING

```
@ECHO ON
@PROMPT $e[0;66;"cd \mydir\level2";13p
@PROMPT $e[0;67;"pctools";13p
@PROMPT $e[0;68;"dir/p";32p
@ECHO OFF
PROMPT $p$ _$g
```

Figure 1: The @ symbol before each PROMPT statement keeps it from being echoed, and the blank line after it gives the ANSI key redefinitions a chance to take effect.

DEL dirname

is interpreted by DOS as

DEL dirname\.*

PRUNE.BAT

```
@ECHO OFF
ECHO Y | DEL %1
RD %1
IF EXIST %1\NUL ECHO Pruning was NOT successful.
```

COMPLETE LISTING



Figure 2: This little batch file will chop a whole directory from your directory tree, files and all.

User-to-User

it, so it's more powerful than PRUNE.BAT. You can download this utility from PC MagNet UtilForum's LIBrary 2, under the name of PRUNE.ARC.

REPEATING BATCH COMMANDS

The User-to-User column of February 13, 1990, contained an article about repetitive looping in batch files. The reader presented a small .COM file that allowed you to specify the number of iterations a batch file should make. The advantage of this method was that you could indicate the number of repetitions you wanted, at the command line. However, if you wanted more than nine iterations, you couldn't enter the number directly, and in any case, you couldn't specify more than 255 iterations. Also, at each iteration, the program writes to a temporary file on the hard disk, slowing things down considerably.

To get around these restrictions, I wrote EDLOOP.BAT (see Figure 3). This batch file creates an EDLIN script file, which creates another batch file containing the statements to be repeated. The new batch file uses brute force to execute the commands, but it is fast. You enter the number of itera-

tions on the command line, and that number is limited only by the memory in your machine.

The key to the creation of the batch file is the EDLIN C (Copy Lines) command. It has a count option that lets you copy specified lines as many times as you want. By placing the lines to be repeated in the batch file and then calling EDLIN to copy the lines n times, you create a file with the instructions listed $n+1$ times. To get the exact number you want, you must delete the first line placed in the batch file.

EDLOOP.BAT illustrates how to do this. Typing EDLOOP n will ring the doorbell n times. While it does not meet your challenge to write a fast loop counter that does not require an external program, it is a fast loop counter, and it requires only EDLIN.

Sean Moriarty
Windsor, Ontario, Canada



There's a noticeable delay as EDLOOP prepares the temporary batch file, but once that's over, the batch file executes at top batch speed. And unlike other methods I've shown in this column, EDLOOP is just as comfortable with 2,000 repetitions as with 20. Yes, it's a brute-force approach, but it works!

EDLIN commands are somewhat peculiar in that the command letter comes *after*

EDLOOP2.BAT COMPLETE LISTING

```
@ECHO OFF
IF "%1"==" " GOTO NEEDNUMB
ECHO ECHO DING DONG > RING.BAT
ECHO ECHO ***** >> RING.BAT

ECHO 1,2,1,%1C > EDLININP.DAT
ECHO 1,2D >> EDLININP.DAT
ECHO E >>EDLININP.DAT
EDLIN RING.BAT < EDLININP.DAT >NUL

CALL RING.BAT
ERASE EDLININP.DAT
ERASE RING.*
GOTO DONE

:NEEDNUMB
ECHO The syntax should be
ECHO EDLOOP2 n
ECHO where n is the number of
ECHO iterations

:DONE
```

Figure 4: EDLOOP2.BAT demonstrates how you modify EDLOOP.BAT to repeat more than one batch line.

all of its parameters. In the line

```
echo 1,1,1,%1C
```

there are four parameters before the C command. The first is the beginning of the range of lines to be copied, and the second is the end of the range. The third is the destination that the lines should be copied to. And the fourth parameter is the number of copies—obtained directly from the number you typed on the command line.

It's important to know which of the parameters is which if you want to repeat more than a single line. The batch file EDLOOP2.BAT in Figure 4 repeats two lines instead of one, with only three changes. First, it appends the second line to the original RING.BAT, using the >> redirection symbol. Next, in the EDLIN C command, it replaces the second parameter, the end of the range, with 2. Finally, it adds a second parameter to the D (Delete) command to specify that both of the first two lines are to be deleted. That's all you need to change if you want to repeat multiple lines.

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EDLOOP.BAT

COMPLETE LISTING



```
@echo off

rem EDLOOP.BAT -- creates a batch file to repetitively execute a
rem series of commands. In this case ring the doorbell.

if "%1"==" " goto NEEDNUMB

rem Open the file ring.bat with the statements to be reiterated

echo echo DING DONG > ring.bat

rem Create input for the Edlin script
rem Use the count option & delete the first existence

echo 1,1,1,%1C > edlininp.dat
echo 1d >> edlininp.dat
echo e >>edlininp.dat
edlin ring.bat < edlininp.dat >nul

rem Run the reiterative batch job & tidy up

call ring.bat
erase edlininp.dat
erase ring.*
goto DONE

:NEEDNUMB

ECHO The syntax should be
ECHO EDLOOP n
ECHO where n is the number of iterations.

:DONE
```

Figure 3: EDLOOP allows you to repeat a batch line any number of times.

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Languages

SIMPLIFY NETWORK LOCKING

As networks become more and more popular, the need for network applications becomes more and more important. QuickBASIC includes a number of ways to share information and protect data integrity. Although you can open a file so that you are the only one who can write to it, this limits flexibility. You could also LOCK and UNLOCK the record you are working on, which is slightly better, except this prevents some otherwise valid activities such as two people looking at the same record while someone else is creating a report.

What is required is a "soft lock" that allows multiple processes to read the same record but won't conflict when it comes time to write. One method is simply to retain an older copy of the record and compare it with the record on-disk before saving changes. But in this case, it is not clear who gets priority. A better approach is to give write privi-

■ **SIMPLIFY NETWORK LOCKING:** A way to allow multiple reads of a file without risking data integrity in QuickBASIC.

■ **INITIALIZING DATA FIELDS:** This technique lets you initialize all data fields in a Pascal Object with a single statement.

leges to the first user who pulls the record up and give everyone else read-only access. After considering a number of ways to implement a "soft lock," I have settled on what I believe is the simplest. The example in Figure 1 shows how it's done.

I use the first byte of the record, which is

often reserved to indicate the deleted status of a record. In this case, I check the status field for each record after it has been retrieved. If it is an "*" then the record is deleted (and there is something wrong with the index!) so I move on. If it is "R" I put the user into read-only mode. And if it reads " " then I put an R into that spot, resave the record, and allow the user to edit the data.

With one contact-tracking application I developed, I instead reserved 2 bytes for the status. Then, instead of using "R" to indicate that the record is in use, I put MKIS\$(UserNum%) in so that the poor user who gets read-only mode can at least know who called the record first. I hope this will help other network applications developers using QuickBASIC and BASIC 7. This will work nicely with other languages as well.

Jonathan Zuck
Washington, D.C.

HOW TO IMPLEMENT A SOFT LOCK

```
TYPE ContactRec
  status AS STRING * 1
  lastname AS STRING * 20
  firstname AS STRING * 10
  address AS STRING * 30
  city AS STRING * 20
  state AS STRING * 2
  zip AS LONG
END TYPE
DIM CRec AS ContactRec

OPEN "CONTACTS.DAT" SHARED AS #1 LEN = LEN(CRec)

INPUT "Which record do you want? ", CRecNo%
GET #1, CRecNo%, CRec

SELECT CASE CRec.status
  CASE "*"
    CRec.status = "R"
    LOCK #1, CRecNo%
    PUT #1, CRecNo%, CRec
    UNLOCK #1, CRecNo%
    GOTO EditRecord

  CASE "R"
    GOTO ReadOnly

  CASE ELSE
    GOTO RebuildNDX
END SELECT
```

Figure 1: Avoid locking out other processes that only need to read the file by giving write privileges to the first user who pulls up the record and read-only access to everyone else.



This is a good technique, and it solves a long-standing problem with the built-in network commands provided with QuickBASIC. As Mr. Zuck has observed, the usual methods for locking and unlocking files unnecessarily prevent legitimate access to a record. Notice that an extra one-character field must be set aside in the record, solely to hold the current lock status. But since many data files are already structured this way (to flag if a record has been deleted), the overhead will usually be inconsequential.—Ethan Winer

INITIALIZING DATA FIELDS

I often use the Turbo Pascal FillChar statement to initialize all the data fields in a record variable with one simple statement:

```
FillChar(MyRec, SizeOf(MyRec), #);
```

Turbo Pascal, Version 5.5, with its object-oriented extensions, opens up a whole new world for Pascal programmers, but mass initialization of an object's fields is not quite as simple as with records.

Why? For one thing, objects with virtual methods have an additional hidden data

Languages

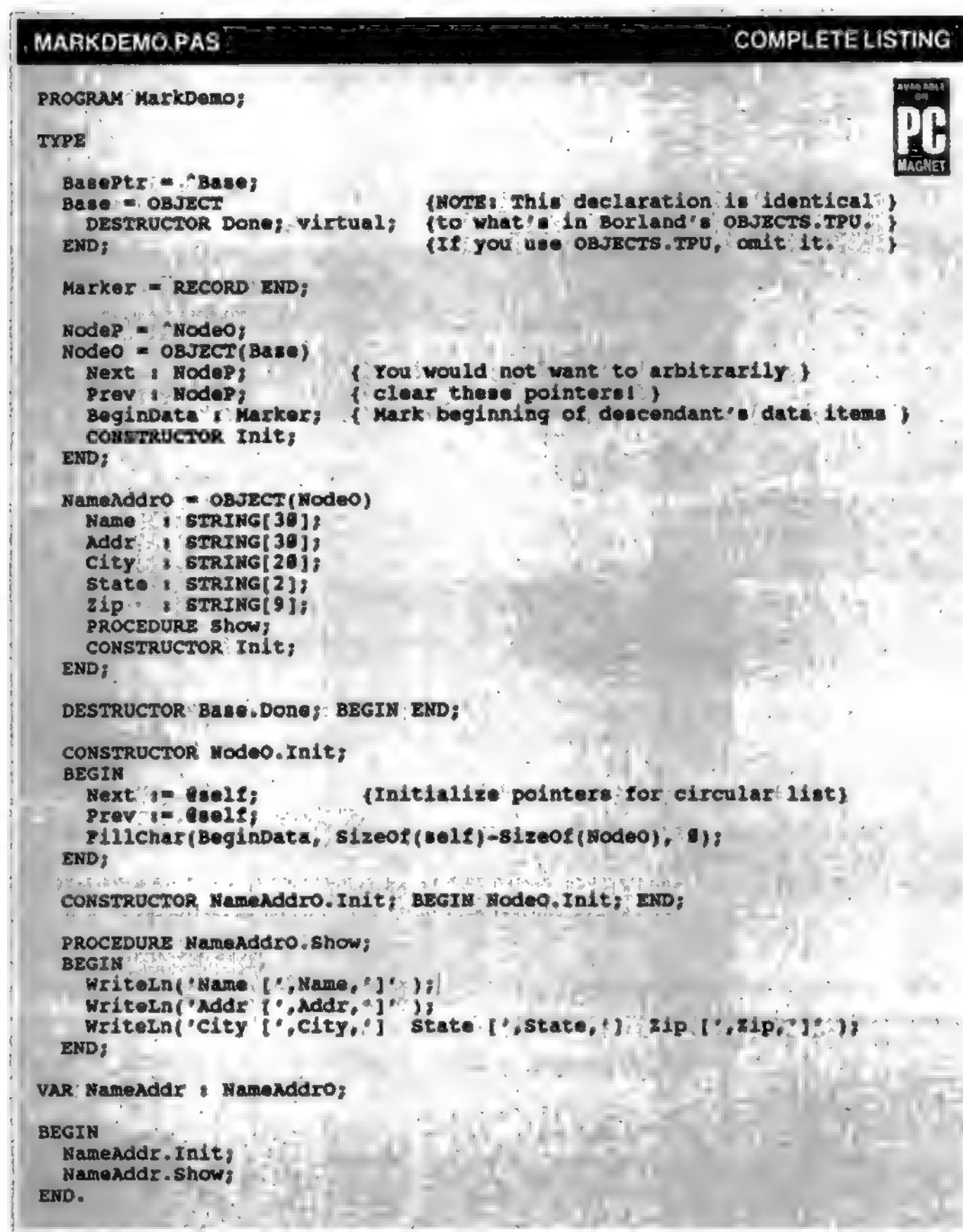


Figure 2: You can use FillChar to clear all of an object's data fields, but you have to avoid wiping out the VMT pointer or you may get some unexpected results.

field, the VMT (Virtual Method Table) pointer. Using the FillChar technique on an object would clear its VMT pointer to zero (NIL), causing disastrous results.

One way to initialize an object's variables is to set them separately within the object's constructor. But this would require each object's constructor to have a line of code to set each variable.

My solution (shown in Figure 2) is to place a marker, called BeginData, in my base node object, NodeO. The marker lets me get the beginning address of the data fields in any descendant of NodeO. Then, with a simple subtraction using the SizeOf function, I can calculate the combined

length of all the data fields in the descendant. The marker allocates no memory at all; it's just an empty record structure. When run, the sample program's output is

```
Name []
Addr []
City [] State [] Zip []
```

This demonstrates that the Init method cleared all the fields of the NameAddrO object to empty strings.

You can extend this technique by placing other markers in your objects and subtracting their offsets to clear specific sets of fields. You can also write generic Load and

Store methods for the Streams objects included with Turbo Pascal 5.5.

William E. Allen
Howell, Michigan



In order to use this technique safely, you have to know *where* in each object the VMT pointer occurs. If you inadvertently clear the VMT pointer, your next call to a virtual method will lead to unexpected results at best. Why? Because every call to a virtual method gets compiled into an indirect call to the address stored at a particular offset in the VMT. If the VMT pointer isn't pointing at a VMT, your program will transfer control to a random location.

The *OOP Guide* that comes with Turbo Pascal 5.5 lays out the structure of an object's data. The VMT pointer appears after the data fields of the first object in the hierarchy that contains any virtual methods. In the example, the Base object has one virtual method and no data fields, so the VMT pointer is the first data field of a Base-type object. It is also the first data field of any object whose type is *descended* from Base. Seemingly minor changes to the hierarchy could move the VMT and render the FillChar statement dangerous. For example, if you made the Base object's Done method static, the VMT of the NodeO object would appear *after* the BeginData field. The same thing would happen if you eliminated Base and made NodeO the root of the hierarchy. In either case, the FillChar statement in the Init method would wipe out the VMT pointer.

Note that any descendant of NodeO can call on its inherited copy of NodeO.Init. The number of bytes cleared depends on the size of the instance calling the method. If a given type has added 234 bytes of data fields beyond those in NodeO, the Init method will clear those 234 bytes.

This technique *seems* to work fine in QuickPascal, too. The QuickPascal manual doesn't describe the internal format of object instance variables, so it's difficult to be totally sure. However, empirically, it works!—Neil J. Rubenking

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by
Jeff Prosis

Tutor

HOW DO THEY RUN?

Would you describe how the three common types of mice work (serial, bus, and PS/2 mouse port), how the mouse driver communicates with the mouse, and how programs in turn talk to the mouse driver?

Jacek Hejnar
St. Hubert, Quebec
Canada



At the software level, bus mice, serial mice, and PS/2 mice are all the same. The mouse driver provides a common interface so that an application program can communicate with a mouse using identical sets of function calls regardless of its type.

At the hardware level, however, these mouse types are fundamentally different. The serial mouse works just like a communications device: It sends data to the

■ **HOW DO THEY RUN? A look at the three common mouse interfaces.**

serial port of your choice each time a mouse event takes place. (A *mouse event* is when a button is pressed or released or the mouse is moved.) A microprocessor inside the mouse transmits a packet of data any time it detects a change in state.

Typically, the mouse driver programs the serial port to interrupt the CPU when a byte of data is received at the port. It does this in the same way a communications program such as *ProComm* would. If the mouse is stationary and no buttons are being activated, no CPU time is tied

up tracking mouse actions.

Many serial mice use the 3-byte packet format standardized by Microsoft to transmit information about mouse position and the state of the buttons to the CPU. Figure 1 shows the format of the packet. Since the Microsoft Serial Mouse transmits data at 1,200 bits per second using 1 stop bit, 7 data bits, and no parity, bit 7 (the left-most bit) in each byte isn't used. Bit 6 is a clock bit that the mouse driver uses to stay in sync with the mouse. In the first byte in the packet, it's set to 1; in the second and third bytes, it's set to 0. Bits 4 and 5 indicate the current up/down states of the left and right mouse buttons. A 0 indicates that the corresponding button is pressed, while a 1 indicates that it's not. The remaining bits in the data packet are combined to form two 8-bit numbers indicating the number of mickeys the mouse has moved in the x (horizontal) and y (vertical) directions since the last report. A *mickey* is the mouse unit of distance, equal to approximately 0.005 inch. By recording mickeys, the mouse driver can track the location of the mouse at all times.

The mouse driver can determine the direction of the movement—up or down, right or left—from the sign of the mickey counts transmitted by the mouse, which are encoded in two's complement form (a common method for representing signed integers on computers). Using this representation, an 8-bit value can store any number from -128 to +127, inclusive. Thus, the mouse can move up to 127 units in either direction (about 0.62 inch) in the time it takes a packet to be transmitted (about 20 milliseconds at 1,200 bps) without missing a beat. That provides enough latitude for you to move the mouse across the table rather quickly, without losing any information in the process. Some mice use higher data rates to increase resolution. Logitech's Series 9 Mouse, for example, operates at 2,400 bps, doubling the range that the mouse may travel between data transmissions.



MICROSOFT SERIAL MOUSE DATA PACKET FORMAT



Bit	Description
x	Not used
1	Always 1
0	Always 0
LB	Left button 0 = pressed 1 = not pressed
RB	Right button 0 = pressed 1 = not pressed
X7-X0	8-bit x-movement indicator (number of mickeys moved in the horizontal direction since the last data transmission)
Y7-Y0	8-bit y-movement indicator (number of mickeys moved in the vertical direction since the last data transmission)

Figure 1: Each time a serial mouse is moved, it transmits a packet of data containing information about mouse position and the state of the buttons to the CPU. This figure illustrates the 3-byte data packet format that is used by the Microsoft Serial Mouse and many other Microsoft-compatible serial mice.

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Not all serial mice use Microsoft's 3-byte packet format. The three-button Mouse Systems Mouse, for example, transmits data in 5-byte packets. The added bits are used to transmit information about the

Fortunately, programs don't have to interface with the mouse at the packet level; that's what mouse drivers are for.

third button (something that the Microsoft format does not support) and information about the mouse's current and last positions, which, among other things, can be used to determine mouse velocity.

How does the serial mouse get its power? It's not battery operated, nor does it have to be plugged into an electrical outlet. Instead, it draws power directly from the serial port through the RTS (request to send) line. The Microsoft Serial Mouse uses five RS-232 lines: TD (transmit data), RD (read data), DTR (data terminal ready), RTS (ready to send), and SG (signal ground). TD is used to transmit packets of data. The driver asserts RTS when it is activated, to make sure power is available to the mouse, and asserts DTR as a signal that it's installed and ready to go. In current Microsoft Serial Mouse implementations, RD is unused.

THE BUS MOUSE

The bus mouse interfacing scheme takes an entirely different approach to linking a mouse to a PC. Unlike the serial mouse, the bus mouse does not contain its own microprocessor. Instead, logic on the bus interface card is responsible for monitoring the mouse and notifying the mouse driver when the mouse is moved or a button is activated. In the most common implementation, the card is programmed to poll the mouse at regular intervals (typically every 1/30 to 1/60 second) and

interrupt the CPU so that the mouse driver can read the current mouse status from registers on the card. Why these interrupt rates? Because 30 to 60 Hz roughly corresponds to the refresh rates of most displays. When the mouse pointer is being moved across the screen, there's usually no need to poll the mouse more frequently, because the screen can't be updated fast enough to show what's happening.

Variations on this basic theme make it difficult to paint a picture of how a "typical" bus mouse operates. Versions of the Microsoft Bus Mouse sold since 1986, for example, contain a custom chip called an *InPort* on the bus interface card. This chip tracks mouse events and—like the microprocessor in the serial mouse—interrupts the CPU only when the mouse is moved or a mouse button is pressed or released. This way, valuable CPU time isn't wasted reading registers on the interface card when the mouse is idle. And thanks to the *InPort* chip, the Microsoft Bus Mouse can be programmed for 30-, 50-, 100-, or 200-Hz operation. It's also possible to have the *InPort* chip interrupt the CPU at regular intervals regardless of whether there's anything new to report, or to forgo interrupts altogether and allow software to drive the mouse strictly by polling it. Using this scheme, the mouse driver (or a program driving the mouse directly) can track mouse position more precisely than programmed 30-to-200-Hz interrupt rates allow. Alternatively, it can tap into the vertical sync pulse generated by the video adapter each time a screen refresh is completed and take time out to read the mouse status during the vertical blanking interval.

A bus mouse does not send packets of data the way the serial mouse does. Instead, status is read directly from lines connecting the mouse to the bus interface card. For example, the Microsoft Bus Mouse uses the nine-pin Hosiden circular connector shown in Figure 2. Of the nine pins, three—SW1, SW2, and SW3—reflect the state of up to three mouse buttons in real time. XA, XB, YA, and YB carry *quadrature* signals that communicate the amount and direction of motion in the *x* and *y* directions to counter registers inside the *InPort* chip. In quadrature encoding, two lines are provided to track motion in a given direction. A pulse on one of the lines—for example, XA—indicates that the mouse has been moved. A pulse on XB, which arrives slightly out of phase with the pulse on XA, reveals the direc-

tion of the movement. If XA leads, then movement is positive; if the pulse on XB comes first, movement is in the negative direction. Values read from the *InPort*'s counter registers are two's complement 8-bit numbers, so they, like the values transmitted by the serial mouse, may range from -128 to +127.

The remaining two pins on the connector serve equally important functions. The bus mouse draws its power from the +5V pin, while the other pin goes to ground.

THE PS/2 MOUSE

The PS/2 mouse is similar to the serial mouse in many respects. This mouse contains its own microprocessor that transmits clocked serial data to the keyboard controller inside the PS/2, just as the PS/2 keyboard does. The controller decodes the information coming in and the PS/2 BIOS makes it available to the mouse driver. Through the BIOS programming interface, the mouse sampling rate may be set to frequencies ranging from 10 to 200 Hz. Typically, the mouse driver will register itself with the BIOS, and the BIOS will activate a handler inside the driver each time a mouse-related event occurs.

One peculiarity of the PS/2 mouse is

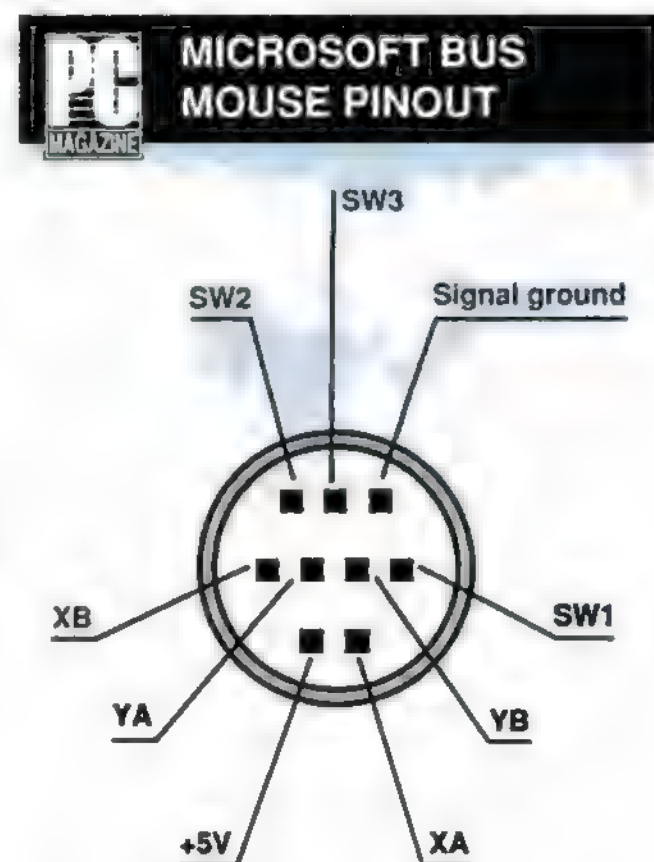


Figure 2: The Microsoft Bus Mouse uses a nine-pin Hosiden circular connector to interface with the bus interface card. SW1, SW2, and SW3 are used to sense the state of the mouse buttons, while XA, XB, YA, and YB carry quadrature signals indicating mouse movement and direction. The mouse draws power from the +5V pin, while the remaining pin goes to ground.

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that the packet format it employs does not include a clock bit as the Microsoft packet does. Furthermore, because the same system board controller is used to decode data coming from the mouse and the keyboard simultaneously, programs that use both the mouse and keyboard on the PS/2 sometimes experience data-overflow conditions that cause the mouse driver to lose synchronicity with the mouse. If there were a clock bit, timing could be reestablished and the overflow condition could be defeated. Without the clock bit, application programmers have been forced to resort to several ad hoc means of maintaining the integrity of the information flowing to the mouse driver. Some of these methods are more effective than others. If your mouse goes haywire or

simply stops working when you run certain application programs on a PS/2 (especially older programs), it's probably for this reason.

It's no accident that you can replace the end adapter on a Microsoft Serial Mouse and plug it into the mouse port of a PS/2. The PS/2 mouse port has six pins, one of which carries power to the mouse. The Microsoft Serial Mouse looks at this line to determine what type of port it's connected to and adjusts the format of the data it sends out accordingly. If the line is asserted (carrying voltage), then the mouse knows it's attached to a PS/2 port. If the line is not asserted, the mouse concludes that it must be attached to a serial port.

THE MOUSE PROGRAMMING INTERFACE

Fortunately, programs don't have to interface with the mouse at the packet level; that's what mouse drivers are for. The mouse driver is the program you install

before running an application that uses the mouse. The Microsoft mouse driver is called MOUSE.SYS or MOUSE.COM. (The only difference between the two is that MOUSE.SYS is installed with a DEVICE statement in CONFIG.SYS, while MOUSE.COM is installed from the command line or your AUTOEXEC.BAT file.) Microsoft and Microsoft-compatible mouse drivers provide a set of 35 high-level function calls that applications can use to communicate with the mouse. These functions are summarized in Figure 3.

For example, if a program wants to determine whether a mouse button is currently held down, all it has to do is make a call to function number 5, Get Button Press Information. The driver, which fields the interrupt generated when a mouse button is pressed or released, keeps track of the state of the buttons. In response to the program's request, the driver returns an integer whose value reflects the current button status. If the left button is depressed, bit 0 is set to 1; if the right button is depressed, bit 1 is set to 1. A value of 0 in either bit indicates that the corresponding button is not depressed.

Mouse driver functions are accessed through interrupt 33h. The following code sequence portrays what a typical call to the mouse driver looks like in assembly language:

```
MOV    AX, 5
MOV    BX, 1
INT    33H
TEST   BX, 1
JZ     NOT_DEPRESSED
```

In general, function codes are passed in register AX, and other parameters in BX, CX, and DX. This particular sequence calls function 5 to retrieve the status of the right mouse button (BX=1 for the right button, BX=0 for the left). On return, bit 1 of the BX register is tested and a branch is made if it's set to 0, indicating the button is not currently depressed.

We don't have the space here to explore each of the function calls in detail. For more information, refer to the *Microsoft Mouse Programmer's Reference* (1989, Microsoft Press), or to *PC Magazine's* July 21, 1987, Lab Notes column ("Mouse Software: See How They Run," page 411). However, there is one function that is so useful and so widely used by pro-

MOUSE DRIVER FUNCTION CALLS	
Code	Description
0	Mouse Reset and Status
1	Show Cursor
2	Hide Cursor
3	Get Button Status and Mouse Position
4	Set Mouse Cursor Position
5	Get Button Press Information
6	Get Button Release Information
7	Set Minimum and Maximum Horizontal Cursor Position
8	Set Minimum and Maximum Vertical Cursor Position
9	Set Graphics Cursor Block
10	Set Text Cursor
11	Read Mouse Motion Counters
12	Set Interrupt Subroutine Call Mask and Address
13	Light Pen Emulation Mode On
14	Light Pen Emulation Mode Off
15	Set Mickey/Pixel Ratio
16	Conditional Off
17	(Not assigned)
18	(Not assigned)
19	Set Double-Speed Threshold
20	Swap Interrupt Subroutines
21	Get Mouse Driver State Storage Requirements
22	Save Mouse Driver State
23	Restore Mouse Driver State
24	Set Alternate Subroutine Call Mask and Address
25	Get User Alternate Interrupt Address
26	Set Mouse Sensitivity
27	Get Mouse Sensitivity
28	Set Mouse Interrupt Rate
29	Set CRT Page Number
30	Get CRT Page Number
31	Disable Mouse Driver
32	Enable Mouse Driver
33	Software Reset
34	Set Language for Messages
35	Get Language Number
36	Get Driver Version, Mouse Type, and IRQ Number

Figure 3: Microsoft and Microsoft-compatible mouse drivers provide 35 different function calls (functions 17 and 18 are not assigned) that a program can use to communicate with the mouse. Collectively, these function calls make up the mouse programming interface.

Tutor

grammers that a discussion of the mouse programming interface couldn't be considered complete without it: function 12, Set Interrupt Subroutine Call Mask and Address.

Function 12 lets a program instruct the mouse driver to interrupt it asynchronously when the mouse is moved or a button is pressed or released. The program passes the mouse driver two objects: a *call mask* and a *subroutine address*. The call mask acts as an event filter. If the program isn't interested in mouse movements or button releases, the call mask can be set up so that the driver interrupts the program only when a button press occurs. The subroutine address is a 32-bit pointer to the subroutine that the program will use to process calls from the mouse driver. By registering itself with the mouse driver this way, a program doesn't have to constantly poll the mouse driver to see what's going on. When something happens, the program is automatically notified and given a chance to act on the event.

OF MICE AND WINDOWS

When you run *Microsoft Windows*, there's an additional layer of software placed between you and the mouse: the *Windows* kernel itself. With *Windows*' message-based architecture, a *Windows* program doesn't have to make calls to the mouse driver to receive information about the mouse. Instead, *Windows* passes the program a message whenever a mouse-related event such as the press or release of a button occurs. In all, *Windows* 3.0 defines 21 different messages that a program may receive from the mouse. These messages are listed in Figure 4.

Of the 21 mouse messages, 10 pertain to the client area of the window (the inside of the window excluding the title bar, menu bar, and scroll bars; in effect, the part of the window that a program "owns"). In general, a message is transmitted to the program's client window procedure when the mouse is moved over the client area of the window and a mouse button is clicked, released, or double-clicked. *Windows* passes additional information along with the message, including the *x*- and *y*-coordinates of the mouse pointer at the time the event occurs and the state of the

left, middle, and right mouse buttons and the Ctrl and Shift keys.

Nonclient-area mouse messages are passed to a window procedure when a mouse event occurs inside a program's window but outside the client area of the window. The nonclient area includes the title bar, the menu bar, the minimize and maximize boxes, the control menu box, the scroll bars, and the window's border. In general, these messages parallel the client-area mouse messages and even have similar names. However, there is one nonclient-area message that stands apart from the rest: WM_NCHITTEST (Non-Client Hit Test).

This message is passed to the program any time the mouse is moved inside the program window—inside or outside the client area—before any other mouse messages are received. It contains the *x*- and *y*-coordinates of the mouse pointer. Normally, programs simply pass this message back to *Windows*, and *Windows* uses it to generate subsequent messages.

A program written for *Windows* may choose to act on or ignore any of the mouse messages it receives. In fact, it's quite feasible (and even common) for *Windows* programs to make extensive use of the mouse without processing a single mouse message. That's because *Windows* takes care of most of the mouse processing. For example, when a menu is pulled down with the mouse, it's *Windows*, and not your application, that responds to the mouse click and displays the menu. Similarly, when the mouse pointer is positioned over a button in a dialog box and clicked, the program receives notification in the form of a message saying an on-screen button was pressed.

The way software interfaces with the mouse depends on the environment in which it's being run. All in all, the mouse is an amazing little piece of hardware, no matter where or how it's being run.

ASK THE TUTOR

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WINDOWS MOUSE MESSAGES	
Client Area Mouse Messages	
Message name	Sent when ...
WM_MOUSEMOVE	The mouse is moved
WM_LBUTTONDOWNBLCLK	The left mouse button is double-clicked
WM_LBUTTONDOWN	The left mouse button is pressed
WM_LBUTTONUP	The left mouse button is released
WM_MBUTTONDOWNBLCLK	The middle mouse button is double-clicked
WM_MBUTTONDOWN	The middle mouse button is pressed
WM_MBUTTONUP	The middle mouse button is released
WM_RBUTTONDOWNBLCLK	The right mouse button is double-clicked
WM_RBUTTONDOWN	The right mouse button is pressed
WM_RBUTTONUP	The right mouse button is released
Nonclient Area Mouse Messages	
Message name	Sent when ...
WM_NCMOUSEMOVE	The mouse is moved
WM_NCLBUTTONDOWNBLCLK	The left mouse button is double-clicked
WM_NCLBUTTONDOWN	The left mouse button is pressed
WM_NCLBUTTONUP	The left mouse button is released
WM_NCMBUTTONDBLCLK	The middle mouse button is double-clicked
WM_NCMBUTTONDOWN	The middle mouse button is pressed
WM_NCMBUTTONUP	The middle mouse button is released
WM_NCRBUTTONDOWNBLCLK	The right mouse button is double-clicked
WM_NCRBUTTONDOWN	The right mouse button is pressed
WM_NCRBUTTONUP	The right mouse button is released
WM_NCHITTEST	The mouse is moved over any part of the window

Figure 4: *Windows* 3.0 defines 21 different mouse messages that can be passed to a *Windows* application. Of the 21 messages, 10 pertain to the client window and 11 to the area outside the client window. Client-area mouse messages are received when the action takes place inside the client window; nonclient area messages are passed when the action occurs outside the client window.



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2. When you receive a CONNECT or CARRIER DETECTED message, enter **Ctrl-C**.
3. At the HOST NAME prompt, enter **CIS**.
4. At the USER ID prompt, enter **177000,5000**.
5. At the PASSWORD prompt, enter **PC*MAGNET**.
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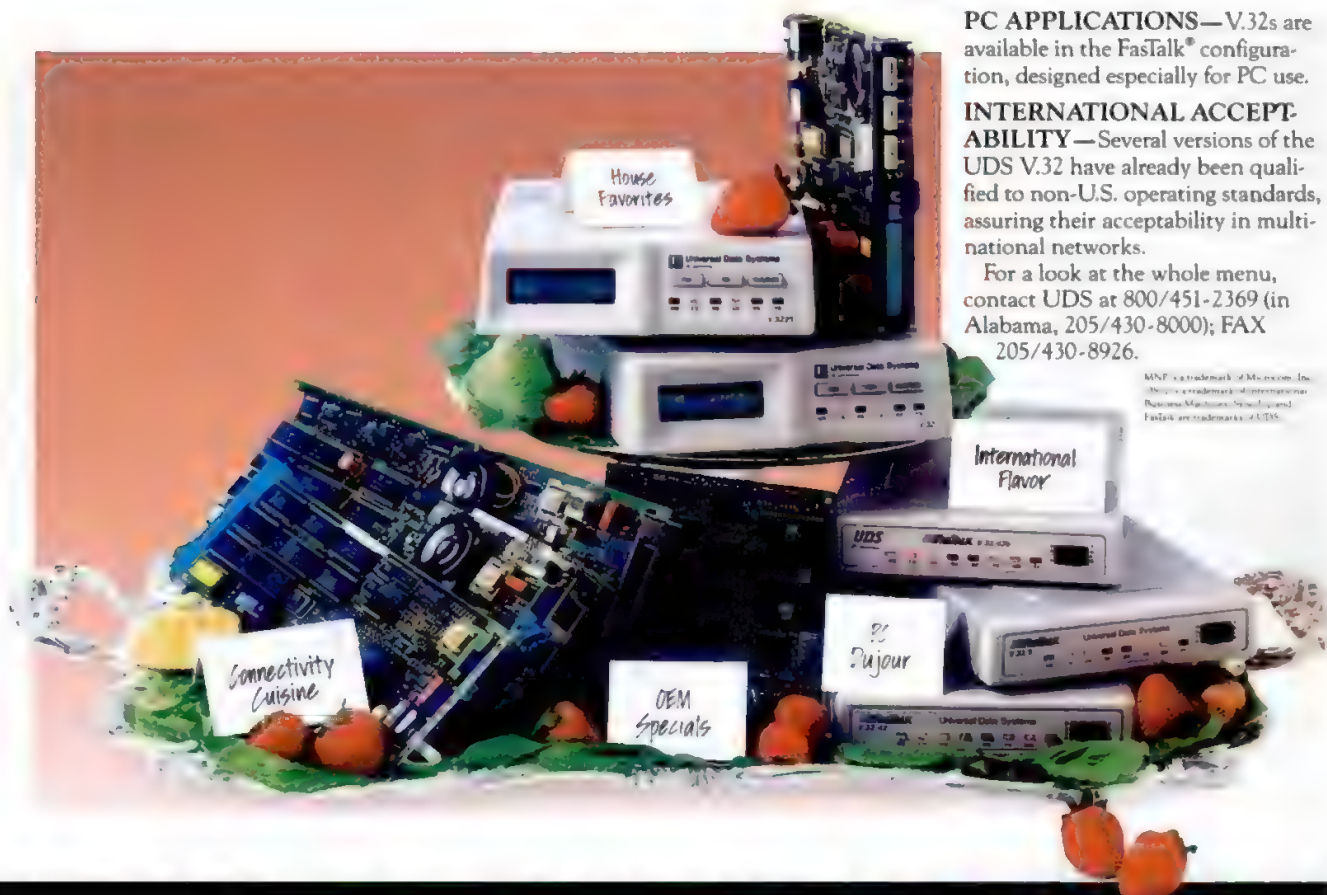
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UDS
MOTOROLA

by
Frank J. Derfler, Jr.

Connectivity

ELECTRONIC MAIL STANDARDS

My job includes purchasing a new electronic mail system for our company. I've read a lot, but I'm still not sure how important X.400 service is. What is the real purpose of X.400 and how would you evaluate it? Can it translate our word processing files to a common format as well as electronic mail?

Prince Smith
Chicago, Illinois



X.400 is the CCITT standard describing a global system for the exchange of electronic mail. The standard is actually a series of specifications, all numbered X.4xx. For example, the X.401 specification defines a model for global electronic mail with many elements. In this complex model, *electronic mail* has a much broader meaning than most people associate with the term today.

It includes user agents (UA), or programs that people use to create and read messages, a message transfer agent (MTA) that moves data across networks and across continents to other electronic mail systems, and a whole series of protocols for communicating between UAs and MTAs.

You might think of the user agent only as an electronic mail program, but it may be a word processor, a spreadsheet, or a database; in fact, almost any application may eventually act as a UA for X.400 messaging systems.

The point is that X.400 is bigger than the selection of your present e-mail system. Practically any high-end e-mail system will have a way to communicate with an MTA—perhaps one offered by some other company—in the near future. All of the upper-level e-mail products today are able to make your message conform to X.400 and become acceptable to some kind of MTA.

I'm a pragmatist, and I believe that X.400, like the OSI protocols, is too complex, cumbersome, and expensive.

■ **ELECTRONIC MAIL STANDARDS:** E-mail moves among systems using X.400 standards.

■ **FASTER COMMUNICATIONS:** Higher-speed alternatives make remote computing reasonable.

■ **RETAINING YOUR LOCAL PATH:** Use a combination of techniques to avoid overwriting the local path.

Many organizations find that establishing one PC to run the Message Handling Services (MHS) software developed by Action Technologies solves their electronic-mail transfer and control needs. While Action Technologies sells MHS direct to the end user, some companies (like Mustang Software) bundle it with their e-mail program, and Novell makes it available at no additional charge to every purchaser of *NetWare*. Specific MHS gateway products link similar and dissimilar e-mail systems without full compliance with the X.400 protocols. X.400 gateways are available for MHS, so you retain the flexibility to move in any direction your network needs take you.

If you're concerned about translation of documents among word processing formats, contact Soft Switch at 215-640-9600. This company specializes in helping organizations link their electronic mail systems, particularly dissimilar electronic mail systems, using a variety of products and techniques. It can sell you a PC loaded with customized software that will move e-mail between applications running on any type of computer, regardless of architecture or operating system. And it offers another service that effortlessly trans-

lates documents among different file formats—and not just word processing formats.

FASTER COMMUNICATIONS

I've installed a nondedicated *NetWare* remote bridge to connect a remote workstation. To do this, I used asynchronous communications with a Hayes Smartmodem 2400 connected to a standard dial-up telephone line.

We've had no problems running programs in the remote workstation, but I'd like to establish higher-speed communications because processes are very slow, especially when there are reads and writes to the file server's hard disk.

Can you tell me how to increase communication speed?

Freddy Orellana
La Paz, Bolivia



The system you're using attempts to move a great deal of low-level data, particularly small packets of DOS actions and confirmations wrapped in IPX, across the telephone line. I don't know anyone who has been happy using remote stations with this architecture, because it is so slow.

You could spend about \$1,500 for two high-speed modems using V.32 signalling and V.42bis data compression (see "9,600-bps Modems: Breaking the Speed Barrier," *PC Magazine*, December 11, 1990). These modems would speed response times to better than half of what they are now.

But you'll get the best response by using any of the excellent modem remote-control products on the market (see our June 12, 1990, feature "The Next Best Thing to Being There") on one PC on the LAN while remotely controlling its processing across the telephone line. In this way, only the screen images and keystrokes move across the telephone line; all of the detailed DOS and IPX actions stay on the faster LAN. The processing is done on the networked PC, but

Connectivity

you get the benefit through remote-control. The remote-control software products, which generally cost about \$150, also have utilities for fast file transfers between the host and remote PCs, so you can bring processed files to the remote PC after they are created and manipulated on the host.

The cost of installing this kind of remote-control system depends primarily on whether you must dedicate a networked PC to the task of acting as a host or you can use a PC you already own as a host. In the LAN Labs, we use relatively inexpensive diskless workstations as host PCs, to keep the costs down.

RETAINING YOUR LOCAL PATH

It's true that trying to retain the path statement when logging into *NetWare* can completely exasperate an inexperienced network manager. While I was trying out the technique described in the October 16, 1990, *Connectivity* column, I discovered the MAP INSERT solution, which can be described as an encapsulation of the path setup. I combine the MAP INSERT command with other techniques to give flexible path statements.

In my AUTOEXEC.BAT, my path statement includes only three elements:

```
PATH=C:\APPLIC\WINDOWS3;C:\;  
C:\APPLIC\DOS_31;
```

I use batch files in the DOS directory to

SAMPLE MAP COMMAND OUTPUT

```
Drive A:  maps to a local disk.  
Drive B:  maps to a local disk.  
Drive C:  maps to a local disk.  
Drive E:  = SERVER1/SYS:DATA/MM_DOC  
          (originally reserved for a local disk)  
Drive F:  = SERVER1/SYS:HOME/MICHEL  
Drive M:  = SERVER1/SYS:APPLIC/M_MATE  
Drive N:  = SERVER1/SYS:HOME/MICHEL/M_MATE  
-----  
SEARCH1:  = S:. [SERVER1/SYS:APPLIC/CLIPPER]  
SEARCH2:  = T:. [SERVER1/SYS:APPLIC/UTIL/PCTOOLS]  
SEARCH3:  = U:. [SERVER1/SYS:DBNETCTL.300]  
SEARCH4:  = V:. [SERVER1/SYS:APPLIC/DBASEIII]  
SEARCH5:  = W:. [SERVER1/SYS:APPLIC/LOTUS/123R22/ALLAYS]  
SEARCH6:  = X:. [SERVER1/SYS:APPLIC/LOTUS/123R22]  
SEARCH7:  = C:\APPLIC\WINDOWS3  
SEARCH8:  = C:\  
SEARCH9:  = C:\APPLIC\DOS_31  
SEARCH10: = Z:. [SERVER1/SYS:PUBLIC]  
SEARCH11: = Y:. [SERVER1/SYS:PUBLIC/IBM_PC/MSDOS/V3.31]
```

Figure 2: This shows how the MAP command's output might look after the user login script is modified to insert the appropriate drive mappings for each person.

redirect the current path before launching the appropriate application.

Next, I construct a system login script according to the number of already installed paths, like this:

```
map s4:=sys:public  
map s5:=sys:\public\%machine%\os  
/os_version  
comspec=s5:command.com
```

This adds the vital network mapping to the existing path, using the technique that was described in your column. As noted there, it's important to make sure that you put a semicolon at the end of the path statement in the AUTOEXEC.BAT file for each workstation.

Finally, the user login script is modified

in order to insert the appropriate drive mappings for each person, as shown in Figure 1. In this way, the original path is encapsulated between the system login paths and the user login paths. The MAP command now produces the output shown in Figure 2.

Michel Ulens
Gent, Belgium



We described how to use the MAP INSERT command in order to prevent overwriting local paths in the January 15, 1991, column. We still continue to get many letters discussing disk drive mapping and login scripts, so I thought it would be a good idea to print this full example of the techniques you can use to configure AUTOEXEC.BAT files, batch files for applications, the Novell system login script, and the individual login script. A network administrator can use specific techniques in all of these areas to provide individuals with customized greetings, access to resources, and operating environments.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay \$50 for any tip we print. Please submit your letter on-disk along with a printout. Then mail your contribution to *Connectivity*, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named PCMAGAZINE LAN LABS). We regret that we're unable to answer letters individually.

SAMPLE USER LOGIN SCRIPT

```
write "Good %GREETING_TIME, %FULL_NAME"  
map display off  
map e:=sys:\data\mm_doc  
map f:=sys:\home\%login_name  
map n:=sys:\home\%login_name\m_mate  
map m:=sys:\applic\m_mate  
map ins s1:=sys:\applic\lotus\123r22  
map ins s1:=sys:\applic\lotus\123r22\allways  
map ins s1:=sys:\applic\ibaseiii  
map ins s1:=sys:\applic\util\pctools  
map ins s1:=sys:\applic\clipper  
map display on  
map  
%systime  
%capture /NB /NFF /TI=2 q=printq_0 p=0  
%capture /NB /NFF /TI=2 q=printq_1 p=1 l=2  
fire phasers 10 times  
drive f:
```

Figure 1: In this user login script, the original path is encapsulated between the system login paths and the user login paths.

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FastData 386/33 \$2399

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Standard Features

- ✓ 33mhz Intel 386-DX processor.
- ✓ 64K high-speed memory cache.
- ✓ 4 megabytes high speed RAM.
- ✓ 100 mb 20ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Full size (shown) or standard size chassis with keylock and reset buttons.
- ✓ 387-DX coprocessor socket.
- ✓ 230 watt power supply.
- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 1mb Video Ram.
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- ✓ FCC Class B approved.

386/33	80 IDE	100 IDE	200 IDE	330 ESDI
Mono	\$2,009	\$2,089	\$2,399	\$3,159
VGA White	\$2,109	\$2,189	\$2,499	\$3,259
VGA Color	\$2,259	\$2,339	\$2,649	\$3,409
VGA 1024	\$2,319	\$2,399	\$2,709	\$3,469



FastData 386/25 \$1999

The optimum combination of features, expandability, and power make the FastData 386/25 an ideal choice for those whose applications demand high speed 32 bit processing and expandability. The value of the 386/25 goes far beyond its price; it comes configured with a full four megabytes of fast RAM, a quick 22 millisecond 65 megabyte hard disk, and maximum VGA displaying 1024 by 768 resolution powered by a high-output 16 bit 512K VGA board. Also, the FastMicro team will configure your FastData 386 exactly the way you want, without sending you shopping elsewhere.

Standard Features

- ✓ 25mhz Intel 80386-DX.
- ✓ 4 megabytes of high speed RAM.
- ✓ 80 mb 20ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive. (For both add \$69)
- ✓ Standard chassis (shown on left) with keylock, speed and reset buttons.
- ✓ 80387-DX coprocessor socket.
- ✓ 200 watt power supply.
- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 1mb Video Ram.
- ✓ Clock calendar, parallel port, two serial ports, and game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots & 5 drive bays.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$99.
- ✓ FCC Class B approved.

386/25	40 IDE	80 IDE	100 IDE	200 IDE
Mono	\$1,539	\$1,689	\$1,769	\$2,079
VGA White	\$1,639	\$1,789	\$1,869	\$2,179
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VGA 1024	\$1,849	\$1,999	\$2,079	\$2,389



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\$1599 FastData SX/20

25% faster than a 16mhz SX, the FastData SX/20 adds even greater performance to its 386 multitasking capabilities. Just \$200 more than our SX/16, this machine also includes a second floppy drive in addition to the standard VGA color monitor and 16 bit VGA adaptor, Keytronics keyboard and 40 megabyte hard drive. The system includes two megabytes of memory and is expandable to eight on the main system board. Remember, when you have questions, need to solve a problem, or want recommendations on products for your system, the FastMicro team is standing by toll-free to provide product support for as long as you own your FastData personal computer.

Standard Features

- ✓ 20mhz Intel 80386-SX processor.
- ✓ 2 megabytes of high speed RAM.
- ✓ 40 mb 28ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard chassis (shown) with keylock, speed and reset buttons.
- ✓ 200 watt power supply
- ✓ 14" Super VGA color monitor with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$99.
- ✓ Guaranteed compatible.
- ✓ FCC Class B approved.

SX/20	40 IDE	80 IDE	100 IDE	200 IDE
Mono	\$1,289	\$1,439	\$1,519	\$1,829
VGA White	\$1,389	\$1,539	\$1,619	\$1,929
VGA Color	\$1,539	\$1,689	\$1,769	\$2,079
VGA 1024	\$1,599	\$1,749	\$1,829	\$2,139



\$1399 FastData 386/SX

Combine the benefits of an advanced Intel 386 processor, the value of a 286 and the advantages of FastData and you've got the FastData 386/SX! This machine is the choice of those who want to run today's powerful 386 and multitasking software, like Windows, and also want to run their favorite DOS applications at surprising speeds. We've made our customers' favorite options standard: it comes with an ample two megabytes of memory, a high performance 40mb hard drive, and 16 bit color VGA. Compare performance, features, and service and you will find no better SX value. Interested further? Try the FastData 386/SX for 30 days; you have to be happy - if not, we'll take it back.

Standard Features

- ✓ 16mhz Intel 80386-SX processor.
- ✓ 2 megabytes of high speed RAM.
- ✓ 40 mb 28ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive. Both add \$69.
- ✓ Standard chassis with keylock, speed and reset buttons (mini desktop shown - add \$50).
- ✓ 200 watt power supply
- ✓ 14" VGA color monitor with 16 bit VGA card with 256K.
- ✓ Clock calendar, parallel port, two serial ports, and a game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$99.
- ✓ Guaranteed compatible.
- ✓ FCC Class B approved.

386/SX	40 IDE	80 IDE	100 IDE	200 IDE
Mono	\$1,149	\$1,299	\$1,379	\$1,689
VGA White	\$1,249	\$1,399	\$1,479	\$1,789
VGA Color	\$1,399	\$1,549	\$1,629	\$1,939
VGA 1024	\$1,459	\$1,609	\$1,689	\$1,999

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CP3208 200mb IDE 25ms	849



Seagate 89mb AT Kit \$399

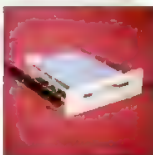
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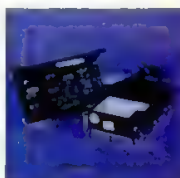


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Hayes	
JT FAX 4800B Internal	139
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Intel	
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287XL	199
387-DX25	479
387-SX16/20	319/349

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Tiny Turbo 286	207
Tiny Turbo Xtra	267

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9600SA	

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Promodem 2400G External	149

USRobotics	
2400 Sportster Int/Ext	119/147
2400 Sportster Int/Ext.	159/199
Couner HST 14,400 Int Ext.	539/579
Couner HST 14,400 Dual Standard Ext.	859

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ZOOM	
HC2400 Internal	79
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- ✓ 200 watt power supply.
- ✓ 287XL coprocessor socket
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- ✓ Clock calendar, parallel port, and two serial ports.
- ✓ Keytronics enhanced 101 keyboard.
- ✓ 8 expansion slots, 6 available.
- ✓ Full documentation.
- ✓ FCC Class B approved.

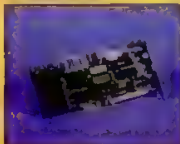
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1410 EGA	325
Diamond Scan 1381	479
NEC	
Multisync 2a	469
Multisync GS 2a	199
Multisync 3d	629
Multisync 4d	Call
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Princeton	Call
Seiko CM1440/1450	519/659
Sony 1304 Multiscan	669
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RLL 16bit 1:1 Hard/Floppy Disk Cont.	69
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14" Super VGA 1024 x 768 28 dp	349

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NEC Silentwriter 2 Model 90 \$1595

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KXP1624	429
KXP4420 Laser	829
KXP4450/4455 Lasers	Call
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Star	
NX1001	149
NX1500	299
NX2410	249
NX2410 / 2415	429 / 569
Texas Instruments Microlaser PS17	1199
Microlaser PS35	1499



System Price	40mb	65mb	85mb	110mb
Monochrome	\$799	\$869	\$969	\$1069
VGA Color	\$1099	\$1169	\$1269	\$1369
VGA 1024	\$1399	\$1469	\$1569	\$1669

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Clanon Professional Developer	449
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Foxbase Plus	177
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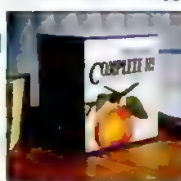
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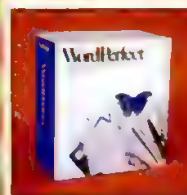


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PC 5/28-6

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01. ☐ Yes 02. ☐ No

2. Please indicate your company or organization's primary business activity: (Check one only)

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 08. ☐ Finance/Banking/Insurance/Real Estate/Accounting
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 10. ☐ Government—Federal
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 99. ☐ Other

4. Is your company a reseller?

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 02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office? (Check all that apply.)

01. ☐ Linked to mainframe
 02. ☐ Linked to mini
 03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply.)

01. ☐ IBM or Compatible PCs
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 04. ☐ Macintosh

8. Do you plan to buy any PC Products?

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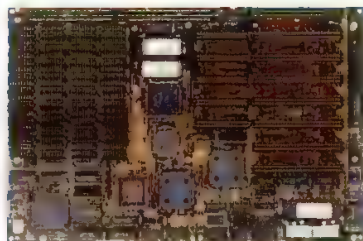
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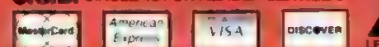
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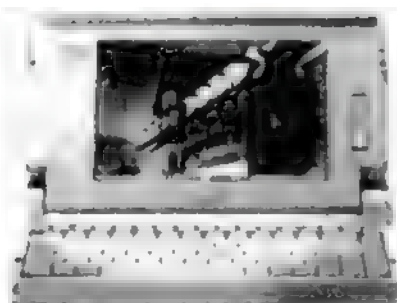
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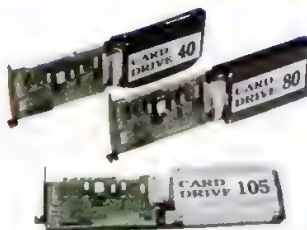


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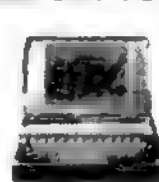
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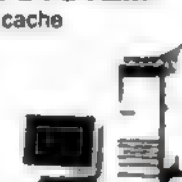
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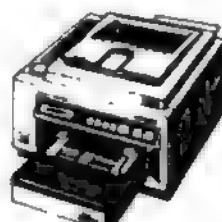
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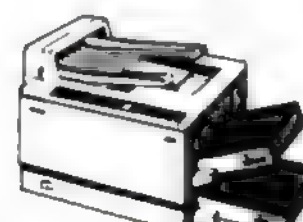
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by
Joe Salemi

Advisor

Help for Readers Making Personal Computer Decisions

LOGITECH MOUSE AND OS/2 1.3

Figure this one out. I have a Gateway 2000 20-MHz 386 and a Logitech Logimouse, and I never had any problems until I bought IBM OS/2 1.3.

I installed the dual boot option so I could use my old DOS applications that won't work in OS/2. But when you reboot to DOS and load MOUSE.COM or MOUSE.SYS, and then reboot to OS/2 when you are through, the mouse appears but it won't work. You can press that "big red button" and reset but it still won't work. But if you turn the computer off and on, lo and behold, the mouse works!

Any ideas? Is my machine hiding some sort of memory cache even through a reset? Or could it possibly be setting some kind of internal switch?

Gary Haley
Fort Worth, Texas



I had the same problem on a Northgate machine with OS/2, Version 1.2, and the Logimouse, so it's not peculiar to your Gateway system.

When you run MOUSE.COM under DOS, the Logimouse defaults to Logitech mode. However, the driver that OS/2 uses for this mouse is actually written for the MSC Technologies PC Mouse, which the Logimouse can emulate. Apparently, the mode information is stored in the electronics inside the mouse itself, so when you do anything other than a complete cold boot between DOS and OS/2 (which resets all the hardware), the mouse is still in Logitech mode, and can't talk to the OS/2 driver.

The solution is rather simple, and can be done in either of two ways. The easiest is to add "PC" to the MOUSE.COM or MOUSE.SYS command line; this puts the mouse in PC Mouse compatibility mode all the time. Or, instead

- **LOGITECH MOUSE AND OS/2 1.3:** Getting the mouse to work when using the OS/2 dual boot option.
- **CURSOR BLINK SPEED:** Changing the rate of the cursor's blinking.
- **DATA RECOVERY FROM A XEBEC EXTERNAL DISK:** What to do when an external hard disk fails.
- **A BIGGER HARD DISK FOR A MODEL 50:** Replacing the 20MB disk with a larger drive.
- **A MUSIC CARD FOR THE MICRO CHANNEL:** Getting the most out of games on a PS/2.

of calling the dual boot program directly, create a batch file that first runs MOUSE.COM with the "PC" command and then calls BOOT.COM.

Either way, the mouse will be in the right mode when OS/2 boots, and will work fine.

CURSOR BLINK SPEED

Having put it off to the bitter end, I recently switched from my wonderful old kludge, a Radio Shack Model 4, to a powerful new PC, a Gateway 386-33. The PC is a jump to light speed for me, but amazingly, the old Model 4 offered one feature I find missing on my new whizbang machine: the ability to change the rate at which the cursor blinks. The rate at which it moves, yes; but not the rate at which it blinks. Is there a secret here?

Ben Gadd
Nemo, Texas



No secrets, Ben, just software solutions. I found two products that control the cursor blink speed, and also give you control over the size and appearance of the cursor itself.

The first is *No-Squint II*

(SkiSoft Publishing Corp., Lexington, Mass.; 617-863-1876; \$50). *No-Squint* was designed primarily for laptop computers, but it will work with any PC.

The second is a shareware product called *Setblink* (Rosetta Stone Systems, P.O. Box 7926, Berkeley, CA 94707; \$25). *Setblink* is available on PC MagNet (see the instructions for joining on page 8 of this issue), CompuServe, various BBS systems, or direct from the authors.

DATA RECOVERY FROM A XEBEC EXTERNAL DISK

My father recently passed away, and we were unsuccessful in locating his will. All of his communications, however, were through his computer. We are certain that there is some very important information on his hard disk. It is an old external disk.

Up until his death it was in working order. Since the computer and disk were moved we have been unable to access the disk. A message appears on the screen that the controller (Xebec Systems Inc.) is malfunctioning.

Today, after attempting to telephone Xebec, we learned that the

company closed six years ago! We can not recover any of the information in the disk unless we can come up with another controller of this type, spare parts, or at the very least an electrical drawing sheet. We are hopeful that you will be able to point us in the right direction.

Helene Gozani
Kibbutz Ginegar, Israel



The very first thing you should do is open up the PC, and try reseating the controller card. Since the system was working fine prior to being moved, there's a good chance that the error is caused by the card having worked loose from its slot because of vibration. The best way to do this is to remove the card, and then put it firmly back into its slot. While you have the card out of the machine, make sure the chips on the card are seated firmly in their sockets. Finally, make sure that the cables are tightly connected to the card.

The next step is to make sure all the connections to the external drive are tight. Check both the cable from the computer, and the power cord (if it plugs into the back of the drive). It may sound like stating the obvious, but make sure the external drive is turned on before you turn on the computer; some of the older external drive controllers wouldn't initialize properly if the drive was off when the PC was started.

If you still get the error message after trying all that, your next step is to contact a data recovery service, such as Rotating Memory Services (El Dorado Hills, Calif.; 800-488-DRIVE or 916-939-7500), Ontrack Data Recovery (Minn., 800-872-2599 or 612-937-5161) or Paul Mace Software (Ashland, Oreg.; 800-523-0258).

These services use sensitive equipment to recover as much data as possible off of unreadable

Advisor

or damaged hard disks.

If they can recover files, the services will send them to you on either floppies, a hard card, or whatever type of device you request.

These services are not cheap and usually require payment of a diagnostic fee before they begin work. The charges are based on the amount of time they'll need to spend on the recovery operation, and the media they use to send the replacement. From your description, you should be prepared to spend between \$200 and \$500.

A BIGGER HARD DISK FOR A MODEL 50

I own a two-year-old IBM PS/2 Model 50-021, the original Model 50 with a 20MB hard drive. I am looking for someone who builds a hard disk controller and hard disk that will work with this machine.

Joseph W. Strickland
Metuchen, New Jersey



Most hard disk manufacturers make external drives for the PS/2s, so if you have the room for another box on your desk, you have a wide variety of choices for expanding your hard disk space.

However, the most elegant solution I've come across for the Model 50 comes from CORE International (Boca Raton, Fla.; 407-977-6055). CORE makes

44MB (\$995) and 80MB (\$1,595) hard disks that directly replace the disk in the Model 50, using the built-in controller. With a 30-millisecond access time rating, you'll also find that these 3.5-inch drives are faster than the one that comes with the Model 50; its access time is a poky 85 ms.

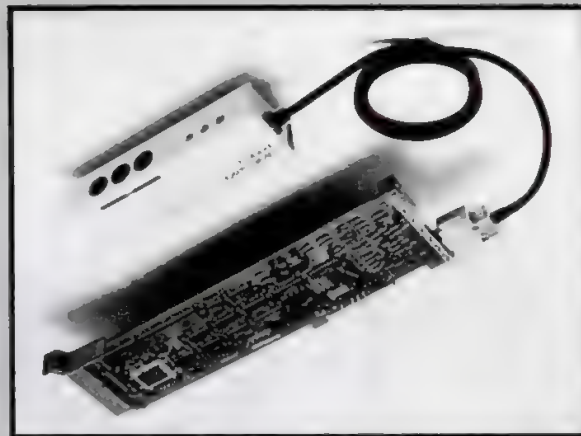
If you want to continue using your 20MB drive (and have an empty slot available), CORE has versions of these disk drives that fit in the drive bay where you would normally put floppy disk drive B. These drives require a special controller card (\$100) from CORE. The hard disks work with DOS 3.1 or later, and with all versions of IBM's OS/2.

Physically installing the drive inside the computer is rather simple, due to the modular construction of the PS/2s. Since the Model 50's CMOS and BIOS don't directly support these drives, CORE includes a disk of patches and utilities to assist you in getting the drives working. CORE also provides technical support if you have any problems installing the drive.

A MUSIC CARD FOR THE MICRO CHANNEL

I own an IBM PS/2 Model 50Z with Micro Channel architecture and am planning to buy a music card, but I cannot find an MCA version of any AdLib-compatible cards. Are there any MCA music cards of any type?

Constantino Matouk
Mexico



The MPU-IMC is a Micro Channel adapter from Roland that connects to either the MT-32 or CM-32L MIDI synthesizer modules.



I can't help you get an AdLib board running on a Micro Channel, but you can do a lot better if you're willing to spend just a few dollars more.

It sounds like you don't really want AdLib compatibility, you want the standard that AdLib only partly adheres to: MIDI.

AdLib compatibility will give you the hardware needed to hear all the sound effects and music on a number of popular PC-based games.

MIDI compatibility will give you the hardware needed to hear many (though not all) of these same games plus it will let you plug into thousands of professional-quality musical instruments and use a music composition editing program.

The product that makes the most sense for an amateur musician with Micro Channel is the CM-32L from Roland, a synthesizer module, with the MPU-IMC, the adapter that plugs into a Micro Channel PS/2. (Roland Corp., Los Angeles, Calif.; 213-685-5141).

Both products are available from Sierra On-Line (Coresgold, Calif.; 800-326-6654 or 209-683-4468) as a \$645 package.

You can simply plug a set of speakers or headphones into the CM-32L and hear sound effects from games. Or you can plug in a MIDI-compatible keyboard and use your PC as a musical composition editor.

The CM-32L is an upgrade of Roland's MT-32 and it will be compatible with software written for the MT-32.

You also may want to consider Roland's LAPC-1, a module that combines the synthesizer and adapter into a single unit.

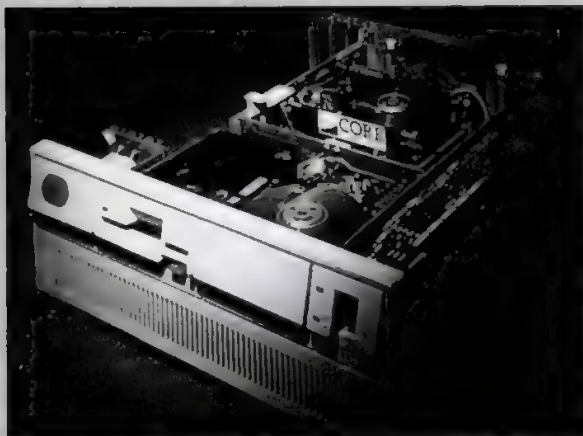
With either hardware choice, you'll be able to choose among lots of software. The two main kinds of MIDI software are sequencers and notation packages. Sequencers turn your PC into a sort of digital tape recorder. You enter music into the sequencer (either from your PC keyboard or from a MIDI instrument), and your MIDI instruments—keyboards and drum machines, for example—reproduce it.

Notation packages print out hard copy of your music, in standard notation.

A good mid-level choice is *Ballade*, available from Dynaware (Foster City, Calif.; 800-445-3962), which is designed expressly for the CM-32L and LAPC-1 synthesizer modules. For its \$195 price, *Ballade* gives you both sequencing and printed music output that should satisfy a serious amateur musician.

ASK THE ADVISOR

Send your questions to PC Advisor, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the instructions for joining on page 8 of this issue). Sorry, but we cannot send personal replies. ■



Core's upgrade kit for the Model 50's hard disk gives you the choice of adding a second hard disk or replacing the original.

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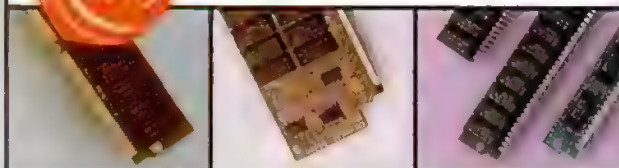
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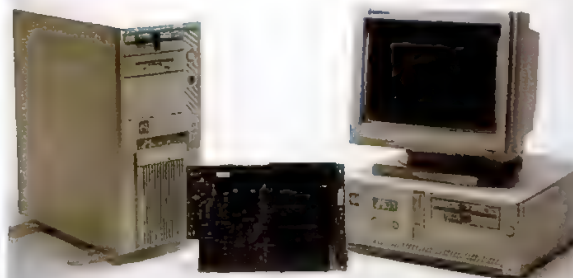
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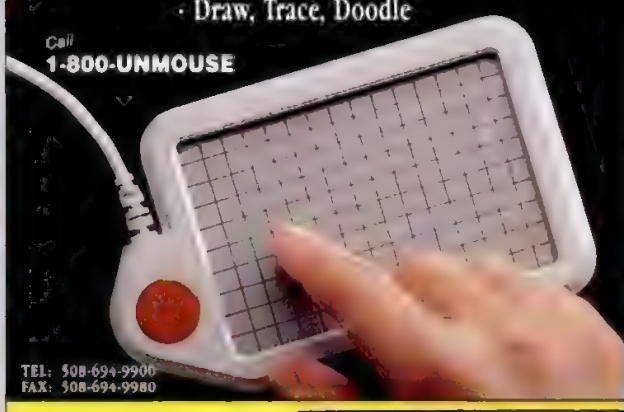
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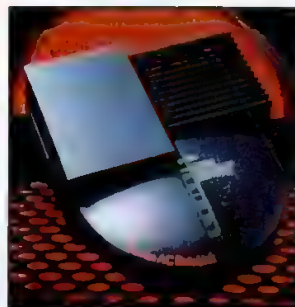
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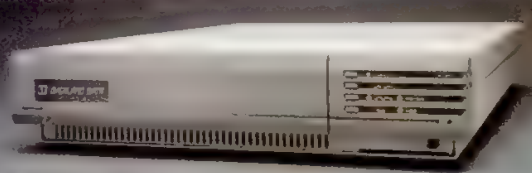
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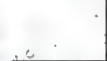
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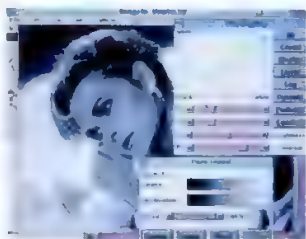


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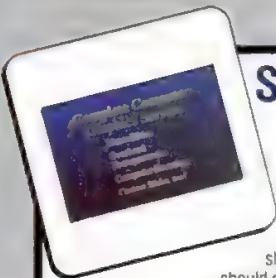
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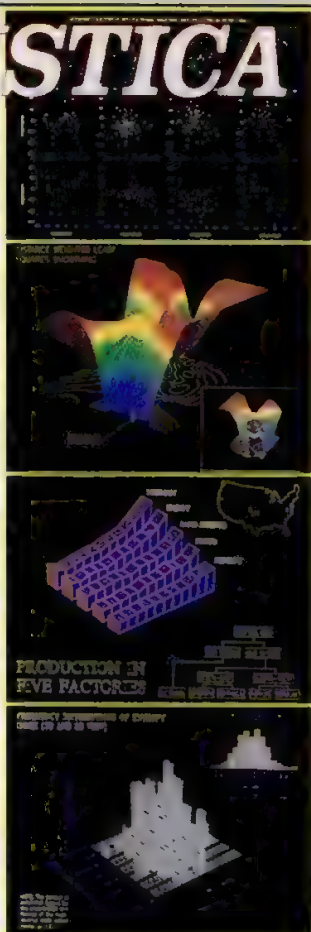
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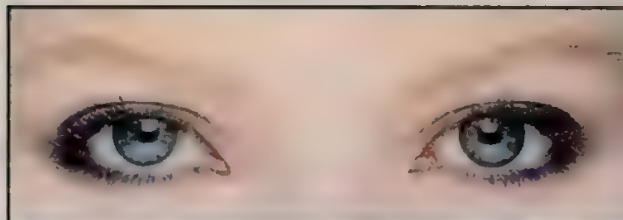
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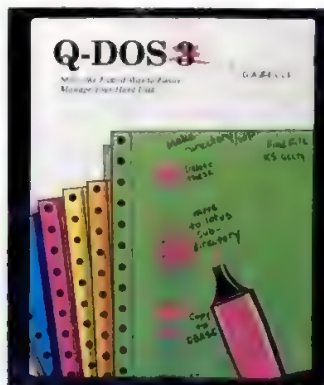
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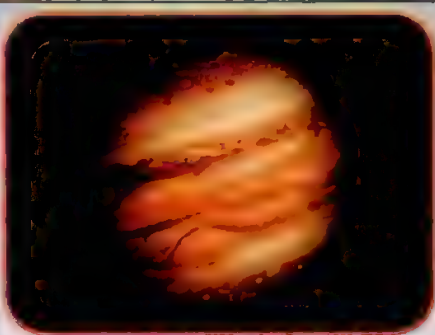
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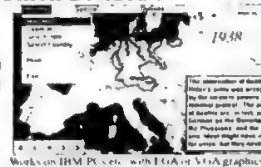
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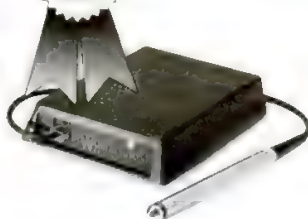


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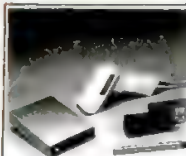


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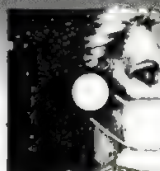
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INSURES YOUR COMPUTERS

Full replacement of hardware, media, purchased software. As low as \$49 yearly. Covers fire, theft, power surges, other accidents. Blanket coverage; no list of equipment needed. Call for information or immediate coverage.

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Local (614) 262-0559

SAFWARE, The Insurance Agency Inc.
2929 N High Street, P.O. Box 02211
Columbus, OH 43202

CIRCLE 766 ON READER SERVICE CARD

PC Magazine Classified

The showcase for products and services in the IBM Standard Market.

SUPPLIES

TONER

OPC kits, toner, & supplies for HP, NEC, Ricoh, Qume, Hitachi, Toshiba, Dataproducts, & many more.
• Franchises Available

We will rebuild your cartridge or one from our stock.
Services from:

\$41.50

LASER Quip
7615 Washington Ave. S.
Edina, Minnesota 55435

800-777-8444

CIRCLE 769 ON READER SERVICE CARD

What PC Magazine Classified is all about—

BIG CIRCULATION.

An astounding audience of 786,000+* brand specifiers, more PC product buyers than any other publication delivers. Virtually every PC Magazine subscriber has the expertise and authority to specify brands of personal computers for their companies.

BIG SCOPE.

Advertising in PC Magazine Classified works in a big way. PC Magazine's enormous scope is one reason—but there are many other big reasons why advertising campaigns succeed in PC Magazine Classified.

PC Magazine Classified takes advertisers' volume sales message to the biggest audience, and supports that message in an editorial environment that encourages direct response buying.

BIG RESULTS.

PC Magazine Classified gets results. Advertising in PC Magazine Classified compels buyers to act, producing an average 16,462 inquiries per issue (an average 146 inquiries per advertiser per issue). Bottom line, PC Magazine Classified promotes active direct response spending, generating as much as \$200 million in sales revenue through the Classified section alone.

Want to start fully utilizing this gigantic marketing tool? Call your PC Magazine Classified Account Representative for more information or to place your ad, 212-503-5115 or 800-825-4237.

Source: Beta Research Study, 1988
*BPA Audit December, 1990

SUPPLIES

TONER CARTRIDGES TESTED • GUARANTEED • 24-HR. TURN.
RECONDITIONED HP, Apple, Canon, QMS, etc.
HP DeskJet Refills! SHARP Z-Series Copiers \$45
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1-800-239-4027 **ADVANTAGE LASER PRODUCTS**
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CIRCLE 767 ON READER SERVICE CARD Tuscaloosa, AL 35401

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Charlotte, N.C. 28273

1-800-462-7143 **\$39.95**

SHIPPING INCLUDED

CIRCLE 768 ON READER SERVICE CARD

To place your ad in
PC Magazine Classified

Call (212) 503-5115 or (800) 825-4ADS

PC Magazine's BusinessCard section is a forum for innovative, hard-to-find and low-cost PC products and services. Ads are listed by product category and include Reader Service numbers to allow fast, easy response.

RATES:

1 issue—\$600, 3 issues—\$550, 6 issues—\$510.
12 issues—\$480, 17 issues—\$460, 22 issues—\$450.
Multiple-ad per issue rates also available.
Prepayment must accompany each insertion.
VISA/MC welcomed.

AD FORMAT:

PC Magazine will design and typeset each BusinessCard ad. Advertisers should furnish type-written copy. Ads include: 1) Headline (one line, initial caps=30 characters maximum, all caps=25 characters maximum), 2) Descriptive copy (5 lines, 225 characters maximum), 3) Company name (same specifications as headline), and 4) Address and telephone number (two lines, 40 characters per line). Sorry, no logos, artwork or camera-ready ads.

DEADLINES:

PC Magazine is published 22 times a year, (bimonthly except for July and August). The BusinessCard closing is approximately two months prior to issue date.

Please send copy and payment to: PC Magazine BusinessCard, One Park Avenue, 3rd Floor, New York, NY 10016, ATT'N: Vickie Pinsky. For more information, call Vickie Pinsky at 800-825-4237 or 212-503-5120, FAX: 212-503-5860.

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We stock memory for all popular PC & Macintosh systems, and Laser Printers. We also carry Intel, Cyrix, and IIT CoProcessors. Give us a call for the best prices, service, and quality products.

MEMORY PLUS

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CD-ROM*WORM*Mageto-Optical
IBM & MAC CD-ROM Discs
Custom Hardware Manufacturing
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CD ROM, INC.

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Compatible. Add support for 3.5" 1.44Mb
Floppies, 101/102 Keyboard F11 & F12 keys,
ESDI and IDE Hard Drives.—Authorized Award
Distributor.

KOMPUTERWERK

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The #1 national discount computer rental company in the U.S. Offices in all major cities.
Featuring IBM, Apple and Compaq—plus a complete host of peripherals. Call us for a solution to your short term computing needs.

PC COMPUTER RENTAL CORP.

National Sales Division
1-800-765-4777

CIRCLE 4 ON READER SERVICE CARD

Hand Your Business Card...

To 786,000+ of the most qualified buyers in the PC market. These brand-specifiers are looking to buy while reading the industry's #1 publication. There is no more cost-effective or efficient way for you to build sales.

BusinessCard

Call 1-800-825-4237 today.

SOFTWARE/ACCOUNTING

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on-line window display of balances, 99 locations
*MULTI-USER Integrated Inv.a/p,a/r,g/l,p.o.
*MULTI-LINGUAL ENGLISH/SPANISH
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MULTI-EASY SOFTWARE, INC.

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100 N. Fed. Hwy #134 Deerfield Bch, FL 33441

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PO Box 19968; So. Lake Tahoe, CA 95706
(916)544-6778

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New Approach to Backups

Analyze, select and sort disk contents by file name, date, size and directory. Then do intelligent selective file backup, cleanup or transfer. Use standard DOS formats and media. Software \$25.00 check/MO.

EAG Systems

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(415)-865-0190

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Intersoft, Inc.

5285 S.W. Meadows Road, Suite 389
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Demo Source

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Demo Line 818-772-7729

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MICRO-PROFIT. For distributors, brokers and jobbers.*SALES&PURCHASE ORDERS*ACKNOWLEDGEMENTS*INVOICES*STATEMENTS*CHECKS*SHPG LABELS*COMMISSIONS*SALES TAXES*GENERAL LEDGER*ACTIVITY TRACKING**

Micro Assistance, Inc.

509-255-9220 FAX 509-255-9455
P.O. Box 157 Liberty Lake, WA 99019-0157

CIRCLE 11 ON READER SERVICE CARD

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Easy-to-use, full-feature Communications software for the IBM PC. Connectivity to mainframes, bulletin boards and on-line services. Volume pricing available. Send \$19.95 plus \$1.50 shipping to:

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Job Cost Accounting Software

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Sequiter Software Inc.

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Call (403) 448-0313 Fax (403) 448-0315

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Ohio Distinctive Software, Inc.

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906-486-6024

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819 Reddick Street, Santa Barbara, CA 93103
(805) 966-3666

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708-832-2161

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Laurel, MD 20726-3058 (301) 776-5828

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RFF Electronics

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Campbell, CA 95008 (800)678-1111 Ext.99

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FPLLOT Corporation

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NCSS

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Phone: 801-546-0445 FAX: 801-546-3907

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Biologic

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703-368-2949 (703-361-8251 fax)

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(415) 964-2844 Fax: (415) 964-4529

CIRCLE 48 ON READER SERVICE CARD



PC MAGAZINE MARKETPLACE

One Park Avenue
Third Floor
New York, NY 10016
Att.: Vickie L. Pinsky

For more advertising
information,
call 212-503-5115
or 1-800-825-4237.

ADVERTISING ACCOUNT MANAGERS

Sr. Account Manager,
Kathleen Morris 212-503-5125
AR, CA (209, 707, 916), CT, IL,
MI, MO, NH, NJ, NM, NV,
OR, WA

Charles Boyar 212-503-5118
AL, CA (415, 818), FL, GA, ID,
KS, VT

Karen Cosgrove 212-503-5156
CA (619, 714, 805), IA, IN, LA,
TN, TX, WI, WY, OVERSEAS

212-503-5176
CA (213), DC, MS, NC, SC, UT,
VA, WV

C. Wesley Walton 212-503-5117
CA (408), DE, HI, KY, MD, ME,
MT, NE, MN, OK

Jelane Westra 212-503-5175
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READER SERVICE NUMBER	PRODUCT	COMPANY	PAGE	READER SERVICE NUMBER	PRODUCT	COMPANY	PAGE	READER SERVICE NUMBER	PRODUCT	COMPANY	PAGE
AFTER HOURS				ENDURANCE TESTS				HARDWARE			
546	Kaleidokubes	Artworx Software Co.	476	603	CompuAdd 333T	CompuAdd Corp.	288	433	Cyrix 83D87-40	Cyrix Corp.	60
548	Mickey's Crossword Puzzle Maker	Disney Software Inc.	476	604	Dell System 333D	Dell Computer Corp.	290	447	Personal SECUREcard reader system	Datamedia Corp.	55
545	SimEarth	Maxis	476	605	Poly 386-33PT	Polywell Computers Inc.	294	445	Elefont Desk/Headline Euro cartridges	Elesys Inc.	55
547	Entertainment Pack for Windows	Microsoft Corp.	476	606	Zeos 386-33	Zeos International Ltd.	298	444	25 in 1 Soft Cartridge	Good Software Corp.	55
549	Crossword Magic	Mindscape Inc.	476	449	Intersect CDR-36	NEC Technologies Inc.	55	431	PowerTrack	Prottance Technologies Inc.	48
550	Crossword Power	Wisico Computing	476	PRINTERS				READ ONLY			
COMPUTERS				602	Kodak Ektaplus 7016	Eastman Kodak Co.	222	397	The PC Configuration Handbook, Second Edition	Bantam Books	65
712	HP/95LX	Hewlett-Packard Co.	33	602	Kodak Ektaplus 7016PS	Eastman Kodak Co.	222	398	The Micro Channel Architecture Handbook	A Brady Book, Simon & Schuster Inc.	65
711	Toshiba T2000SX	Toshiba America Information Systems	36	601	HP LaserJet IIISi	Hewlett-Packard Co.	210	396	Intel's Official Guide to 386 Computing	Osborne McGraw-Hill	65
CONNECTIVITY				710	Laser Jet IIIP	Hewlett-Packard Co.	38	SOFTWARE			
429	StarGroup LAN Manager Server, Version 3.4	AT&T Computer Systems	318	PRODUCTIVITY				704	Hotwin, Version 1.5	Abacist Software Co.	44
427	Atlantix Axxess, Version 1.0	Atlantix Corp.	313	DEPARTMENT				437	askSam, Version 5.0	askSam Systems	49
425	Pathworks for DOS	Digital Equipment Corp.	335	PROGRAM NAME / DESCRIPTION				442	WindowView	Atlantix Corp.	55
425	Pathworks for OS/2	Digital Equipment Corp.	335	PAGE				709	QuattroPro, Version 3.0	Borland International	43
424	Pathworks for Ultrix	Digital Equipment Corp.	335	Utilities				448	LAN Automatic Inventory	Brightwork Development Inc.	55
426	PC DEC Windows	Digital Equipment Corp.	335	Environments				Get Control Over Your WIN.INI File with PROGSET.EXE.			
428	HP LAN Manager/X HP-UX, Version 1.01	Hewlett-Packard Co.	318	Power Programming				Exploring Windows Bitmaps: How They Work, How to Use Them.			
542	Ported NetWare, Version 3.0	Interactive Systems Corp.	338	Windows				Containers and Objects: Object Linking and Embedding in Windows.			
543	POWERfusion, Version 1.3, with POWERfusion Extras for DOS	Performance Technology Inc.	344	Windows				Expand the environment space in the DOS shell.			
423	The Clarkson Packet Driver Collection	Russell Nelson	312	Databases				How to add color to interface items in Windows 3.0.			
544	PC-NFS, Version 3.0.1	Sun Microsystems Inc.	328	Databases				Streamline certain tasks with Clipper 5.0's enhanced array handling.			
DATABASE MANAGEMENT				Databases				Using the Microsoft C compiler as a preprocessor for dBASE.			
412	dBASE IV, Version 1.1	Ashton-Tate	131	Spreadsheets				Kick into STEP mode while your 1-2-3 macros are running.			
415	Ingres, Version 5.0	ASK Computer Systems Inc.	161	Spreadsheets				Jump between distant areas on Excel worksheets.			
416	Omnis 5, Version 1.2	Blyth Software Inc.	162	Spreadsheets				A small problem with Release 3's Translate utility.			
418	Paradox, Version 3.5	Borland International Inc.	181	The Working Word				WordPerfect's LABEL feature can put a header on every column.			
409	Clarion Professional Developer, Version 2.1	Clarion Software	112	User-to-User				Some handy keystroke combinations enhance cursor movement.			
410	Condor3	Condor DBMS Services Inc.	122	User-to-User				A trick for suppressing useless on-screen messages.			
411	DataEase, Version 4.2	DataEase International Inc.	125	User-to-User				A batch file that will prune your directory tree.			
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COMING UP

■ THE BEST BACKUP SOFTWARE

You know you need to back up, but do you really? Protecting your data is becoming less of a chore as backup software continues to get faster and easier to use. PC Magazine Labs tests 11 packages, all of which have the capability to back up not only to floppies, but also to tape and network drives.

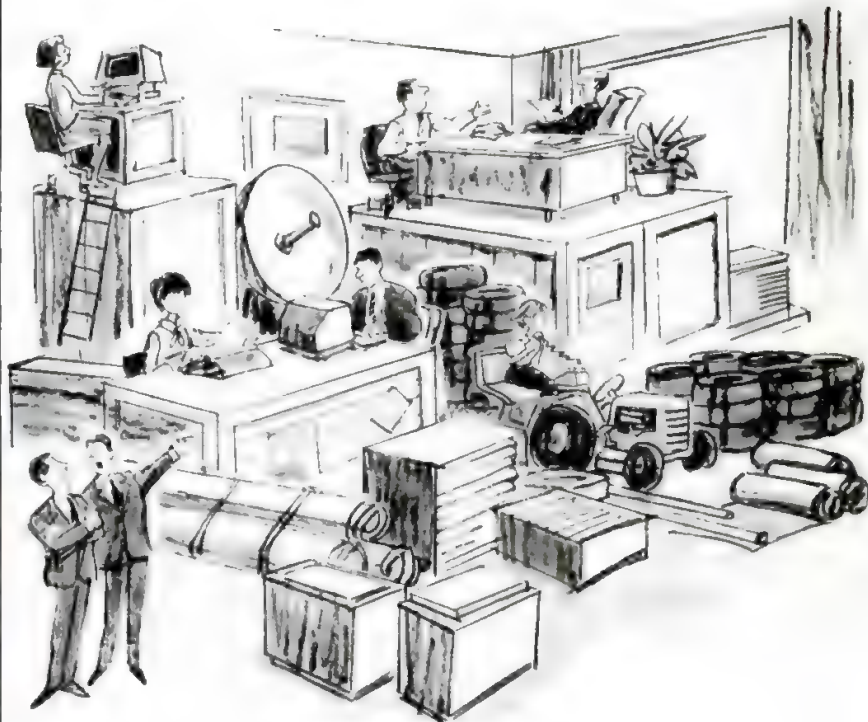
■ MAGNETO OPTICAL DRIVES



As storage needs outgrow available hard disk space, mass storage is becoming one of the hottest debates in the computer industry. One solution is the magneto optical (MO) drive, which can add removable, rewritable, high-capacity data storage to your PC. PC Magazine reviews nearly 20 drives with 600MB capacity, and shows you how they work—and how they compare to other optical technologies such as WORM. We'll also help you choose the drive with the right controller, interface kit, and software to fit your needs.

■ 25-MHz 486 PCs

As prices continue falling, 25-MHz 486 PCs are becoming a viable option for more than just the power user. As a CAD workstation or a file server, the 486/25 certainly fits the bill. But even users who think they are only interested in speed and smoother operation of Windows 3.0 will find other benefits with this powerful machine. PC Magazine Labs tests 29 EISA, MCA, and ISA systems, in the first of a two-part series of reviews. (Stay tuned for 33 more 486/25s, in our June 25 issue.) ■



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After Hours

Products for the Leisure Side of Personal Computing

Design and Construct Brave New Worlds with Maxis's *SimEarth*

GAMES
by Nate Zelnick

The distinction between games and simulations was blurred last year by Maxis's ground-breaking *SimCity*, which places you in the city-planner's seat of the metropolis of your choice. Few simulations—and few games, for that matter—have ever attracted as fanatical a following. Model cities have popped up on bulletin boards around the country, as users share and compare their work with other, equally dedicated, urban developers. Schools love the learn-and-play environment; *SimCity* serves as an excellent example of the educational potential of PC-based games.

In the wake of this success, Maxis has embarked on a more ambitious project—management of an entire planetary system—with *SimEarth*. This time you are a cross between a god, an environmental engineer, and a terrestrial janitor. The basic premise is derived from James Lovelock's holistic view of planetary existence, the Gaia theory, which posits a continuity between all aspects of the natural and social sciences, from chemistry to sociology. Gaia is the Greek goddess of the Earth, sort of a prototypical Mother Nature. You become her assistant and it is your daunting job to keep the planetary machine running smoothly and efficiently.

There are dozens of factors to keep track of, and each one affects the others. For example, the ratio of carbon dioxide, water vapor, and methane to oxygen in the atmosphere affects the overall air temperature. Too

much of the first three (called "greenhouse gasses") and your planet starts to heat up, with devastating effects on the biosphere (areas that support life: the crust, oceans, and lower atmosphere). Global warming melts the icecaps and raises ocean levels which, in turn, reduces the number of oxygen-producing land plants. The resulting planetary chain reaction can destroy all life.

BALANCE IS CRUCIAL

Like in *SimCity*, your success depends upon finding a successful balance without squandering resources (energy in this case, instead of cash as in *SimCity*).

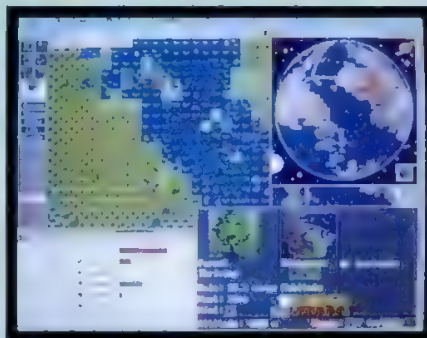
There are several levels of difficulty. At the most basic level (called "experimental mode"), you have unlimited energy and connections between systems are relatively straightforward. At the most difficult level, the environment is in complete chaos and you are critically short of energy.

There are also scenarios that deal with specific problems, including developing and supporting life on a dead planet, sparking civilization for mammals stuck in the Stone Age, saving the Earth from pollution, and terraforming Mars and Venus. There is also a scenario based on Daisyworld, Lovelock's famous example of Gaia at work, in which you must balance eight different types of daisies, each with their own specific needs and environmental impacts.



SimEarth comes with eight planetary scenarios, including one that allows you to build your own world from scratch.

Magnificent graphics and a wealth of reporting windows make constructing a planet a pleasure rather than a chore.



GAMES

Ever wanted to play
God? Try
SimEarth

New games just for
Windows from
Artworx and
Microsoft

Three programs for
crossword addicts
of all ages.

You control your planet by influencing specific systems and calculating the overall effect of your actions. You have a wide range of tools, each of which has several effects on different planetary systems. Placing single-celled life in the oceans, for example, starts the chain of evolution that can lead to the development of intelligent life, but it also has radical effects on the ratio of gases in the atmosphere. Advancing civilization too quickly taxes the resources both of the planet and of the social systems that your intelligent life has developed. This can lead to overpopulation, wars, pollution, plague, and starvation. Not advancing fast enough leads to social stagnation. Patience, clever maintenance of resources, and a far-ranging plan will get you where you want to be, but sometimes playing *SimEarth* feels like running a marathon in a log-jam while juggling chainsaws.

One of the real joys of *SimEarth* is its beautiful interface. As in *SimCity*, you do most of your work in an editing window, which gives you a close-up of part of your world and allows you to drop objects exactly where you want them. There are also two satellite views: a flat map window and a globe. Each ap-

CONTINUES

After Hours

SimEarth

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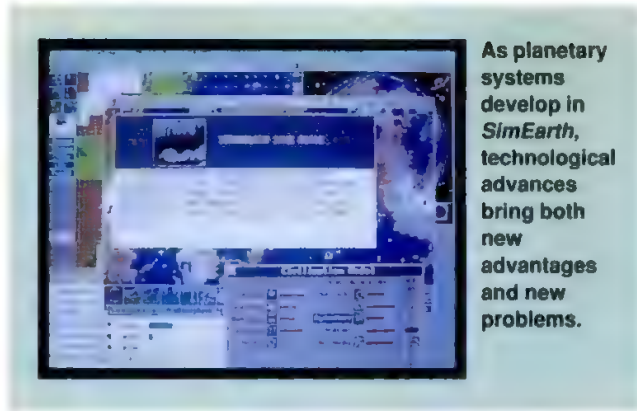
pears in its own window that can be placed wherever you want on-screen, or hidden with the click of a mouse button. There are other wonderful touches; when you bring up the globe, for instance, it rotates, which also causes the edit window to scroll. The icons that represent life change as the lifeforms evolve. Both satellite views have buttons keyed to specific information, giving you instant global data on important factors like the location and density of rainfall, wind directions, air temperature, and the location and level of civilization.

CUSTOMIZED REPORTS

A rich variety of reporting windows includes line graphs of specific factors over time, and a report of your relative success with suggestions of where to go next. Models of your atmosphere, geosphere, biosphere, and civilization allow you to fine-tune each particular system. You can also pull down a picture of Gaia herself, who will give you an instant review of each of your actions. Like the map windows, the reporting windows can be placed wherever you want, allowing you to customize the screen for the specific information you need.

SimEarth is not without flaws. The Mars and Venus scenarios, which require drastic atmospheric changes before the planets can support life, don't adjust air temperature, regardless of your actions, although this is a precondition for a successful terraforming exercise. You can develop a viable atmosphere for life anyway, but I spent a frustrating week trying every combination of factors. Another mistake in these scenarios is in their treatment of the game's time frame. The scenario description states that you have 500 years to terraform the planets. I let the simulation run unattended for 1,500 years without a single indication of having failed.

Be aware, also, that when Maxis says the game requires



As planetary systems develop in *SimEarth*, technological advances bring both new advantages and new problems.

640K, they mean it. You may have to unload TSRs to get *SimEarth* to run.

These are minor problems, though. Once you know about the bugs in the Mars and Venus games, you can play without

worry; the glitches don't affect any of the other game factors. As this review was being written, Maxis was reportedly hard at work on bug fixes for the few small blemishes.

Though the interface makes

playing easy, *SimEarth*'s underlying ideas are complicated. Luckily, the documentation and on-line help functions are geared to help you grasp the intricacies of Gaia. The manual, which contains a 50-page general introduction to earth science along with another 150 pages of game information, is one of the few that I have actually read cover-to-cover and enjoyed. The ties between the science lesson and the game are tight, and the better you get at running the world, the more you learn about it.

List Price: *SimEarth*, \$69.95.

Requires: 286 processor, 640K, hard disk, DOS 3.0 or later. Maxis, 2 Theater Sq., #230, Orinda, CA 94563; 800-521-6263, 415-254-9700.

CIRCLE 645 ON READER SERVICE CARD

Games from Artworx and Microsoft Prove that Doing Windows Can Be Fun

GAMES
by Don Trivette

With *Microsoft Windows* gaining new converts faster than a dog gets fleas, it's not surprising to find a few games designed specifically for the *Windows* interface. *Kaleidokubes*, from Artworx, is a particularly challenging mind-bender that falls into this graphical group. Part Rubik's Cube, part *Tetris*, and part dominoes, *Kaleidokubes* challenges you to place multi-colored cubes on a board so that adjacent edges are the same color. You rotate and position a cube—à la *Tetris*—until you find a place for it to fit. Points are

awarded for the number of side matches: 5 points for one side, and 40 points when all four sides match.

Kaleidokubes can be played against the clock, against the computer, or by two players. Even though play is straightforward, Artworx thoughtfully includes written documentation with the game. Also included is a DOS version for the windowless.

This is one of those games that's hard to put away. It's easy to play, but requires enough skill and thought to keep you occupied. Although scoring is the object, I find considerable satisfaction in watching the colorful

patterns emerge. The longer you play, the more the screen looks like a kaleidoscope.

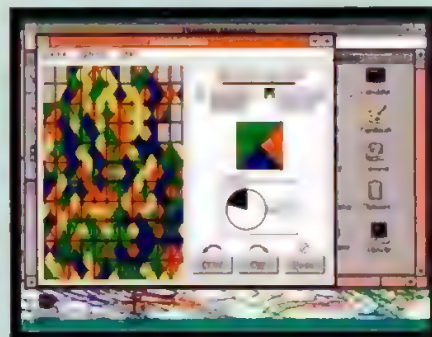
Everyone who buys *Windows* 3.0 gets two computer games in the package: A strategy game called *Reversi* and the venerable card game *Solitaire*. The latter is played on an electronic card table with a superb mouse and graphical interface. *Solitaire* is quick, clean, and intuitive—and I wish I had a version that could run under DOS.

Those who want a few more puzzlers should check out Microsoft's *Entertainment Pack for Windows*, which bundles seven board and card games along with a screen-blanking utility (most DOS blankers don't work under *Windows*) for a modest \$39.95.

Golf and Cruel are variations of standard *Solitaire* that use the distinctive Microsoft card table. In Golf, the idea is to move cards displayed across the top of the screen to the discard pile at the bottom—always following sequence, although not necessarily suite. A six in the discard pile, for example, may be covered with either a five or a seven from the top of the screen. The game ends when, and if, all cards end up in the discard pile.

Cruel is another variation on *Solitaire*, with four aces across the top of the board and 12 piles of cards underneath. The idea is

CONTINUES



Kaleidokubes takes advantage of the *Windows* environment and creates beautiful patterns as you play.

After Hours

Games for Windows

CONTINUED

to end up with all the cards stacked on the aces.

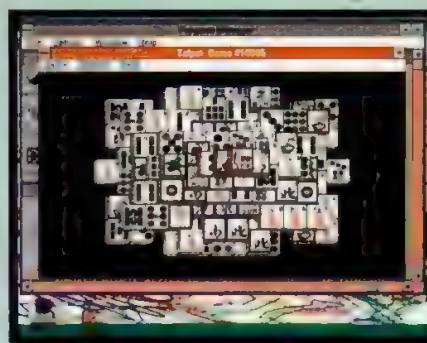
The third card game—really a tile game—is Taipei, an Oriental puzzler whose rules are as confusing as a Mandarin maze. It's a Solitaire version of the ancient game of mah-jongg, which was all the rage in this country in the 1920s. The purpose is to remove all the hieroglyphic-like tiles from the playing area. It's said to involve both skill and chance, but I never caught on to the subtleties.

Minesweeper is quick fun while you're on hold waiting for the accounting department. The

idea is to locate land mines in a grid with either your foot (as in Boom! you're dead) or a mine detector.

The other games in the *Entertainment Pack* are familiar. There's a version of *Tetris*, a 4-by-4-by-4 tic-tac-toe, and a peg-jumping game. The only blemish in the *Entertainment Pack* is a lack of written documentation. Perhaps Microsoft thought that with all the help screens, index fingers, and pointing inherent to the Windows environment, paper documentation was unnecessary. Nevertheless, I felt a real need for printed instructions for Taipei.

Overall, *Entertainment Pack* gets good marks. Both *Cruel* and *Golf* are entertaining variations of Solitaire, Taipei is a sure winner for mah-jongg enthusiasts, and the others are long-time



Microsoft's *Entertainment Pack* for Windows includes Taipei, a variation on the age-old game of mah-jongg.

favorites redone for the Windows interface. The graphics are great, and even if you don't like a particular game, it's fun just mousing around.

List Price: *Kaleidokubes*, \$24.95. **Requires:** Windows 2.1 or 3.0. Artworx Software Co., 1844 Penfield Rd., Penfield, NY

14526; 800-828-6573.

CIRCLE 546 ON READER SERVICE CARD

List Price: *Entertainment Pack for Windows*, \$39.95. **Requires:** Windows 3.0. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; 800-426-9400, 206-882-8080.

CIRCLE 547 ON READER SERVICE CARD

Crossword Software Generates Puzzles for Enjoyment or Education

GAMES
by Don Trivette

The first crossword puzzle appeared in a New York newspaper on December 21, 1913. It was an instant success, and crosswords soon became a major form of indoor entertainment in the days before television. Now that the computer can perform the time-consuming process of creating a puzzle, crosswords are enjoying a revival.

Whether you intend to use crossword puzzles to drill and test students, create personalized greeting cards, or give preschool-

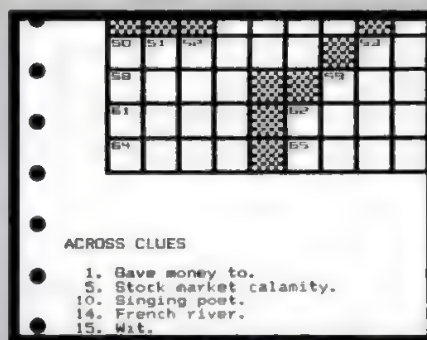
ers a head start, here are three PC-based puzzle makers worth looking at.

Mickey's Crossword Puzzle Maker—from Disney Software—is aimed at five- to eight-year-olds, but younger kids can pick it up, and even adults are likely to find it entertaining.

You can create a puzzle by entering your own words and clues, or use one of the word lists designed specifically for three different age groups. You can also mix word groups. In addition, there are hundreds of built-in picture clues with which to define words.



Mickey's Crossword Puzzle Maker allows dot matrix printouts of cartoon images along with the customized puzzles.



A simple and direct approach characterizes *Mindscape's Crossword Magic*. You can manually add words to fill gaps.

After your word list is complete, *Mickey's CPM* automatically arranges the words into a puzzle and displays the clues. You can add various Disney-related pictures, like Alice in Wonderland, Bambi, Mickey Mouse, and Snow White, as backgrounds. Puzzles can be solved on the screen or printed, along with the background, on a dot matrix printer.

The top-notch user interface supports a mouse, the graphics are all Disney, and there are enough options and features to keep an adult hacker happy. *Mickey's Crossword Puzzle Maker* is one of the best kids' programs I've seen.

Crossword Magic, from *Mindscape*, is a no-nonsense puzzle maker. You won't find color or graphics here, or ameni-

ties like a mouse interface or a built-in word list. *Crossword Magic's* major virtue is its ease of use. You simply enter a word list and the accompanying clues; the program does the rest.

None of the three crossword puzzle makers I tried could create a symmetrical puzzle like those found in newspapers and magazines. Although they used various schemes to fit words together, the results left a lot of blanks and gaps, which printed as black space. For puzzle fans who insist on a minimum of black spaces, *Crossword Magic* has a manual mode that lets you add words to its creations. But keep in mind that fitting words into an existing puzzle is even more challenging than solving the *Sunday New York Times* cross-

CONTINUES

After Hours

Crossword Software

CONTINUED

word. *Crossword Magic* does a good job of printing a puzzle, even allowing you to manually adjust the paper between the grid and the clues; the software does not offer support for laser printers but has drivers for a wide variety of dot matrix printers.

Crossword Power is a true dark horse. It was developed and programmed (and is constantly being improved) by Terry Jepson, a ninth-grade junior-high science teacher in Wisconsin Rapids, Wisconsin. He designed the software to make puzzles for his classes, so it has lots of features teachers will appreciate.

The printed puzzle has a space at the top for a student's name, class, and section. The word lists can be given descriptive names like American History—1st Six Weeks, and they can be com-

bined to produce "final exam" puzzles. For teachers hardy enough to grade 15 separate puzzles, there's an option to print a custom crossword for each student in the class.

The user interface for *Crossword Power* is less polished than those in the other programs. The mouse-controlled cursor, for example, is a box rather than the customary arrow; but it gets the job done. My major problem with *CP* is that Jepson has added so many bells and whistles and printer options—teachers are constantly offering suggestions—that it takes some time to understand the program's structure and capabilities.

Each of the three crossword puzzle makers is aimed at a different audience. If you've got kids and you like crossword puzzles, *Mickey's Crossword Puzzle Maker* is a must-own. It's a great program. If you want a no-frills, easy-to-use program, buy Mindscape's *Crossword Magic*. Teachers at the junior high, senior high, and college

level can use either *Crossword Magic* or *Crossword Power*, although the latter is specifically designed for teachers and has a site licensing arrangement. ■

List Price: *Mickey's Crossword Puzzle Maker*, \$44.95.

Requires: 512K RAM, DOS 2.0 or later, graphics adapter; mouse recommended; off-disk copy protection. Disney Software Inc., 500 S. Buena Vista St., Burbank, CA 91521; 818-567-5360.

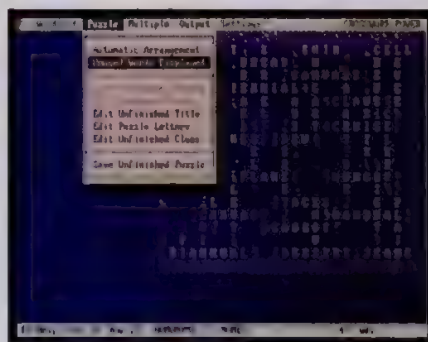
CIRCLE 546 ON READER SERVICE CARD

List Price: *Crossword Magic*, \$49.95. **Requires:** 320K RAM, graphics adapter, DOS 2.0 or later; key-disk copy protection. Mindscape Inc., 60 Leveroni Ct., Novato, CA 94949; 800-231-3088.

CIRCLE 549 ON READER SERVICE CARD

List Price: *Crossword Power*, \$39.95. **Requires:** 320K RAM, DOS 2.1 or later; Wisco Computing, P.O. Box 8, Wisconsin Rapids, WI 54495; 715-423-8189.

CIRCLE 550 ON READER SERVICE CARD



Crossword Power has many features intended to help teachers develop puzzles for use in the classroom.

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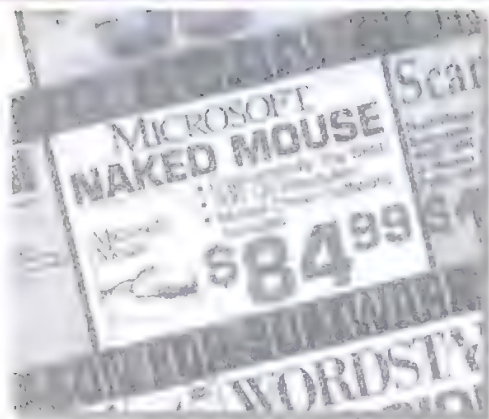
by
Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing



CARTOON RICHARD TENNANT



Technospeak-wise, the Fry's Electronics advertisement in the San Jose Mercury News (Dec. 7, 1990) is correct: For years, mouse makers included "free" paint, CAD, design and multitasking programs. To reduce the cost, they stripped away the free software, producing what's known as a naked mouse.

If your entry is used in Abort, Retry, Fail? we'll send you \$50 and a PC Magazine T-shirt. Caution: In case of multiple entries, the postmark date, neatness and completeness of entry are considered. Winners this issue: Arthur J. Stoppe (200-watt computer), David Knecht (utility wipes out PC), Leonard Cox (naked mouse), Tina Tomasetti (HP Deskblotter).

Norton AntiVirus Utility Wipes Out PC, Network Bugs

Symantec Corp. of Cupertino, Calif., last week began shipping The Norton AntiVirus, a PC utility designed to detect and eradicate known DOS vi-

Ambiguous headline of the week, from PC Week, December 17, 1990.

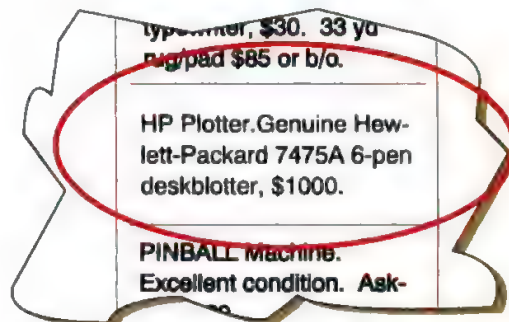
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- VGA color graphics card...

Flyer sent to Chemical Bank Delaware credit card holders.



—The Binghamton (NY) Press & Sun Bulletin, November 4, 1990

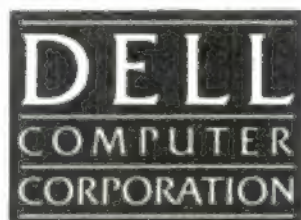
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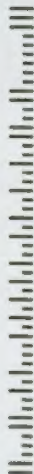
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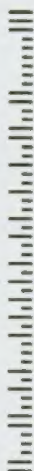
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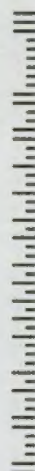
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